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Proceedings of

DIRECT SEEDING IDEAS 2001

January 10, 2001
Knights of Columbus Hall, Falher

January 11, 2001
Dunvegan Motor Inn, Fairivew

Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT

ALBERTA REDUCED TILLAGE INITIATIVE

PFRA
Prairie Farm Rehabilitation Administration

Acknowledgements

Thanks to all the participants, speakers, helpers and the Dunvegan Motor Inn for their involvement in the Direct Seeding 2001 Workshop held in Falher on January 10 and in Fairview on January 11. Approximately 140 people attended from across the Peace Region from as far away as Fort St. John, High Level and Valleyview.

Special thanks to the organizing committee, including Randy Perkins and Tom Staples of Alberta Agriculture, and Blair English of PFRA for their assistance in locating sponsors, speakers, advertisers, as well as registration and room setup.

Thanks to the speakers for their presentations at the two days, and for providing the material for this proceedings.

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Special thanks to Monsanto for sponsoring lunch and Zeneca for a jug of Touchdown.

Thanks to Agriculture Financial Services Corporation, Ducks Unlimited, Town of Fairview, and Alberta Agriculture for supplying door prizes. Thanks to the Alberta Institute of Agrologists (Peace River Branch) for processing the income and expenses.

Special thanks to Linda Brazel for formatting and producing these proceedings.

We hope the day was beneficial for you and hope to see you next year for another edition of the Direct Seeding Workshop.

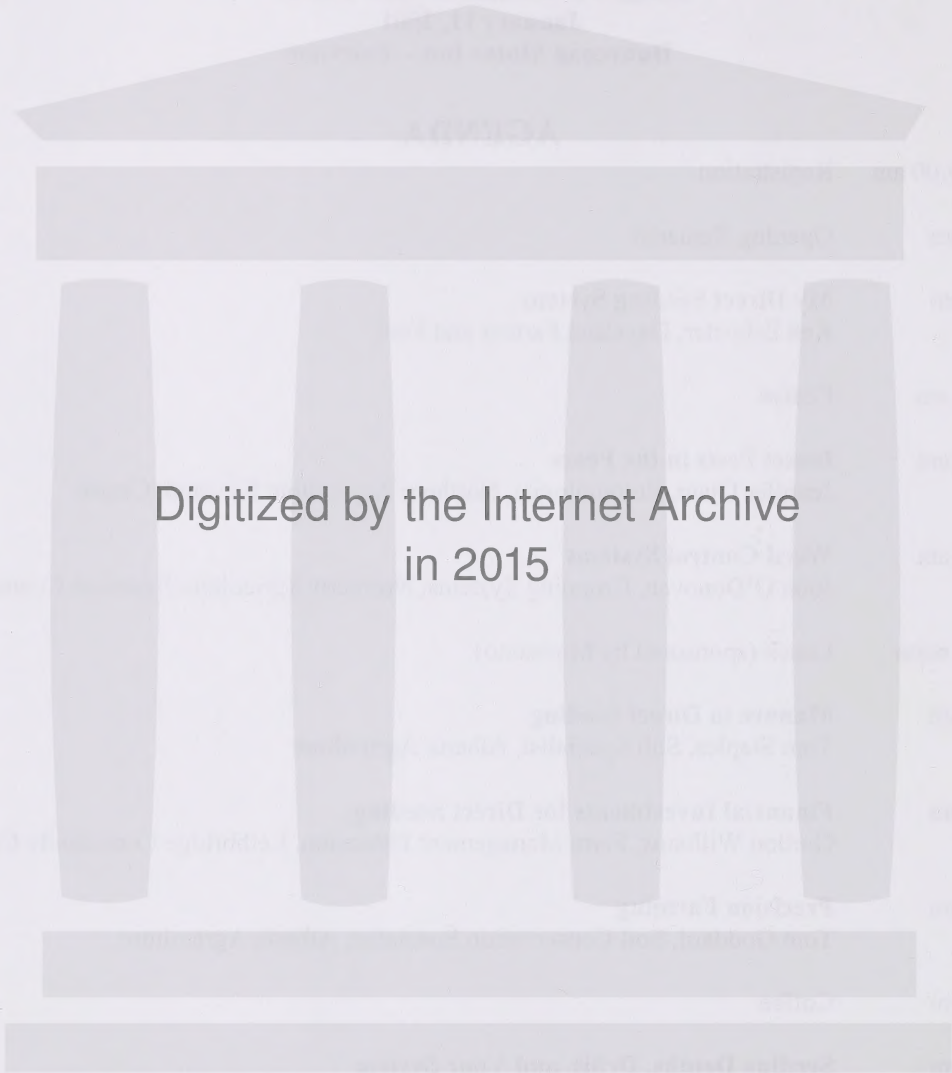
John Zylstra, P.Ag.
Conservation Coordinator, Peace Region
Regional Advisory Services
Alberta Agriculture, Food and Rural Development

2001 "Direct Seeding Ideas" Workshop

January 10, 2001
Knights of Columbus Hall - Falher
January 11, 2001
Dunvegan Motor Inn - Fairview

AGENDA

8:30-9:00 am	Registration
9:15 am	Opening Remarks
9:30 am	**My Direct Seeding System** Ken Eshpeter, Daysland Farmer and Poet
10:15 am	Coffee
11:00 am	**Insect Pests in the Peace** Jennifer Otani, Entomologist, Northern Agriculture Research Centre
11:30 am	**Weed Control Systems** John O'Donovan, Cropping Systems, Northern Agriculture Research Centre
12:00 noon	Lunch (sponsored by Monsanto)
1:00 pm	**Manure in Direct Seeding** Tom Staples, Soil Specialist, Alberta Agriculture
1:30 pm	**Financial Investments for Direct Seeding** Gordon Williams, Farm Management Extension, Lethbridge Community College
2:10 pm	**Precision Farming** Tom Goddard, Soil Conservation Specialist, Alberta Agriculture
2:40 pm	Coffee
3:00 pm	**Seeding Depths, Drills, and Your System** Gary Ropchan, Coordinator, Central Peace Conservation Society
3:30 pm	**Nitrogen Fertility to Minimize Crop Lodging** Tracey Nicholson, Technologist, Central Peace Conservation Society
3:50 pm	**Pea Fertility in Direct Seeding** Paul Laflamme, Pulse Specialist, Alberta Agriculture



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No-Till in East-Central Alberta, Canada

Ken Eshpeter
Farmer and Poet
Daysland, Alberta

No-Till in East-Central Alberta, Canada

Ken Eshpeter
Daysland, Alberta

This is one producer's perspective that has been developing over a 10-year period.

I farm in a flat to gently undulating part of the Alberta "Parkland." We receive about 10-12 inches of growing season precipitation annually, which results in fairly predictable moisture stress for crop development most years.

Our clay loam soils usually reward us with good crops annually. But, no-till farming helps us manage soil moisture more effectively and thus reduce some of the stress of growing crops on dry land.

Over the years I have had many "learning experiences" developing my direct seeding and no-till system. The following is a brief outline of what I have learned.

I break the process of no-tilling on my farm into five basic stages or processes which are utterly important. They are interdependent factors which operate together to produce successful crops. These factors are:

1) Residue Management
2) Weed Control
3) Seed Placement
4) Fertilizer Placement
5) Rotation

1) Residue Management - Successful no-tilling begins at harvest. The harvester must chop and spread the straw and chaff evenly. Without this step I would be beat. Uniform chopping and spreading allows your seeding tool to smoothly, and without bunching, place the seed into the ground.

2) Weed Control -Weed control begins at harvest for two reasons:
   a) You can assess prior crop weeds and their impact on your next year's crop
   b) You can use pre-harvest spray to control certain weeds for the next year's crop like
      - Quackgrass
      - Canada and sow thistle
      - Toad flax

As experience with no-till increases, our flexibility with weed control increases. We can decrease our dependence on certain herbicides somewhat. Use all the chemistry possible and hopefully ward off the lurking monster of"herbicide resistance." My system allows me to rotate virtually every chemical group. This takes much planning but I am certain that it will be worth it.

3) Seed Placement - Seed placement is crucial! I must have a *system* that allows for shallow seeding and that creates a blackened area on top of the seed row. Because our springs tend to be

cool, a blackened ribbon above the seed row brings the soil temperature to normal very quickly.

4) Fertilizer Placement - My opener system allows me to separate all the fertilizer from the seed. High rates of N must be separated from the seed zone. Some evidence to suggest that in certain crops like peas, the granular fertilizer should be separated as well.

5) Rotation - Crop rotation is very important. It helps resolve weed issues, residue issues and disease issues. My main rotation has been Canola - Cereal - Peas - Cereal. I plan to move to a rotation of Peas - Canola - Cereal - Cereal, and will also include flax and other special crops.

What does no-till help me do?

I) Decrease Machinery Costs
2) Build Soil Quality
3) Reduce Weed Seedbank
4) Reduce Hours of Operation (Fuel Costs)
5) Reduce Erosion Potential
6) Improve Moisture Use Efficiency - Increasing Yield Potential
7) Become More Aware of My Soil

No-Till farming is exciting, dynamic and incredibly interesting. It has made farming like being on a good vacation.

Now if I could just make farming pay.

Agricultural Insect Pests Our Y2K Bugs

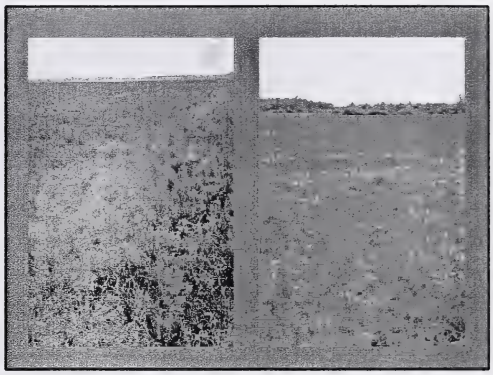
J.K. Otani
Agriculture and Agri-Food Canada
Northern Agriculture Research Centre
Beaverlodge, Alberta

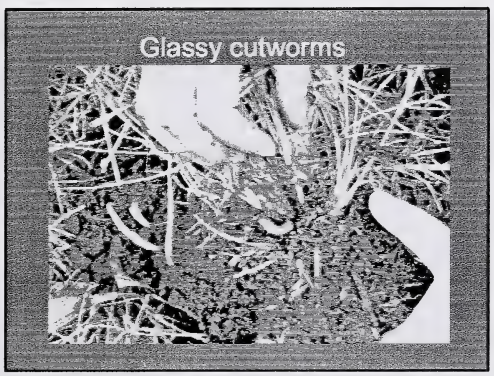
AGRICULTURAL INSECT PESTS

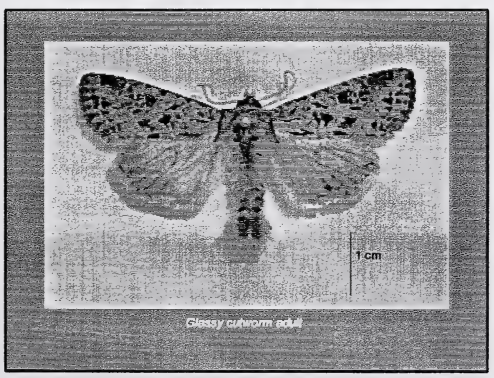
- Our Y2K Bugs

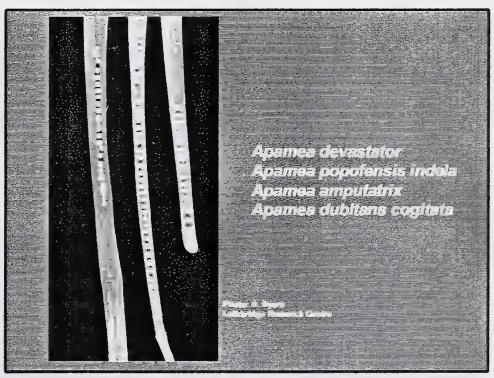
J.K. Otani

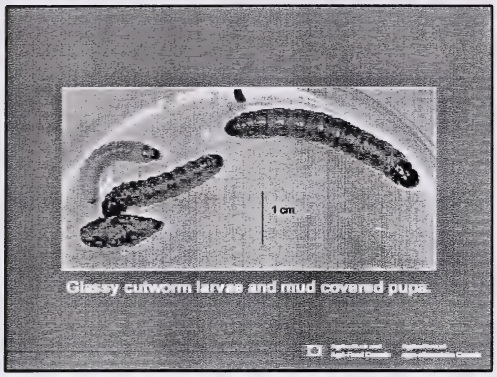
Beaverlodge Research Farm
Agriculture and Agri-Food Canada

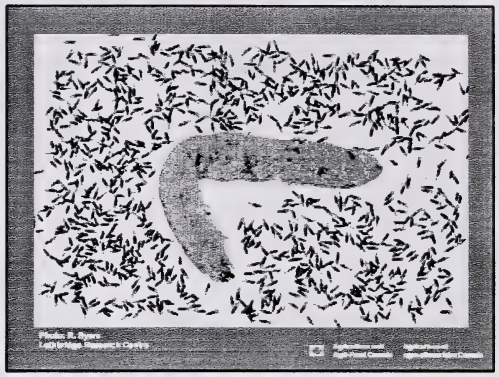


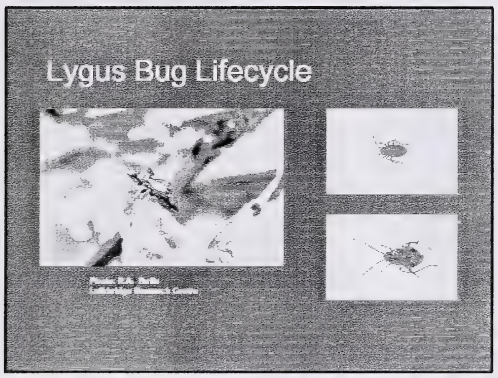


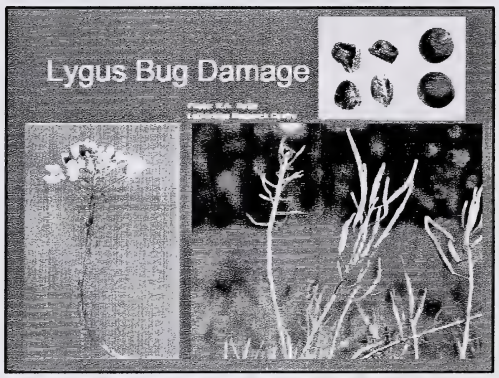


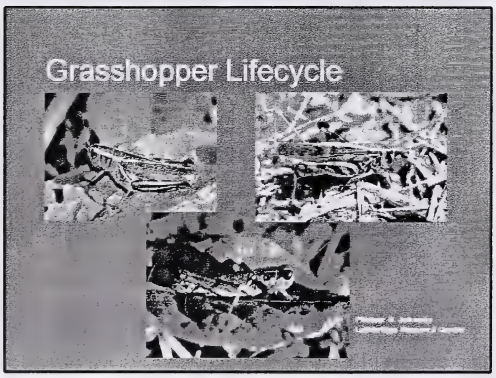


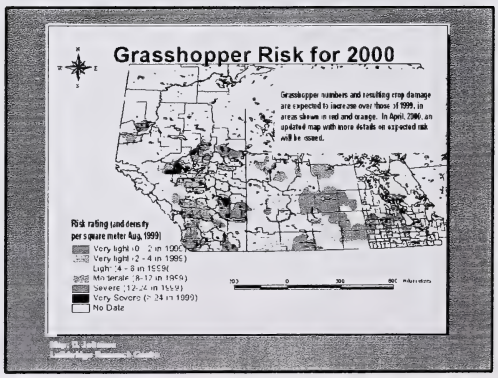

1 cm
Glassy cutworm larvae and mud covered pupa

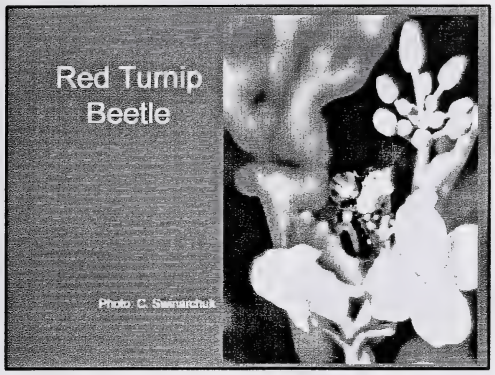


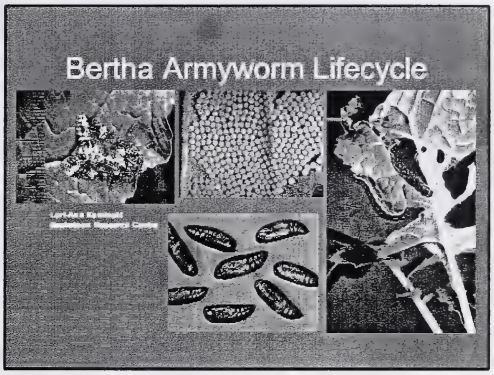

Lygus Bug Lifecycle

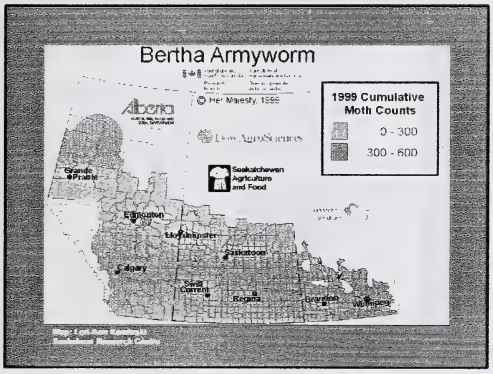

Lygus Bug Damage

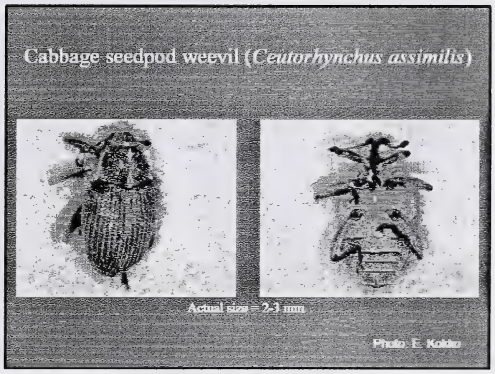

Grasshopper Lifecycle


Grasshopper Risk for 2000
Grasshopper numbers and resulting crop damage are expected to increase over those of 1999, in areas shown in red and orange. In April, 2000, an updated map with more details on expected risk will be issued.
Risk rating (and density per square meter 4aug, 1999)
Very light (0 - 2 in 1999)
Very light (2 - 4 in 1999)
Light (4 - 8 in 1999)
Moderate (8-12 in 1999)
Severe (12-24 in 1999)
Very Severe (> 24 in 1999)
No Data


Red Turnip Beetle
Photo: C. Sawatchuk


Bertha Armyworm Lifecycle


Bertha Armyworm
1999 Cumulative Moth Counts
0 - 300
300 - 600
Saskatchewan Agriculture and Food
Edmonton
Saskatoon
Regina
Brandon
Winnipeg


Cabbage seedpod weevil (Ceutorhynchus assimilis)
Actual size = 2-3 mm
Photo: E. Kokko

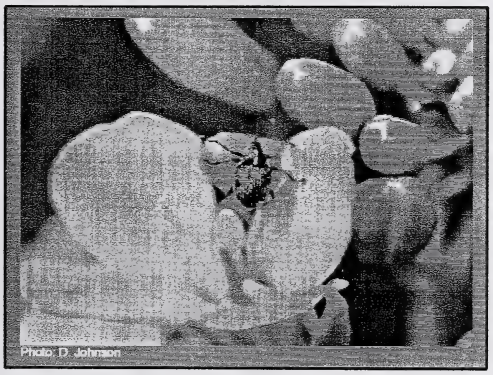


Photo: D. Johnson

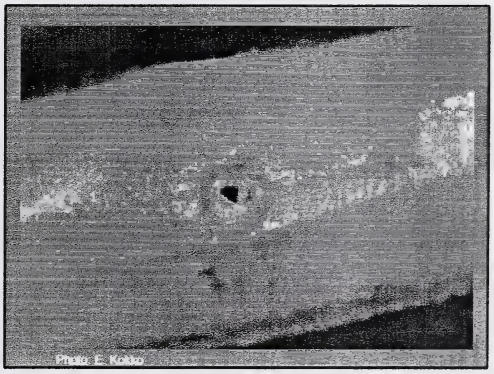
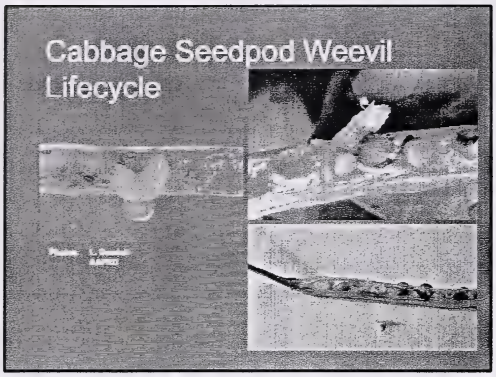
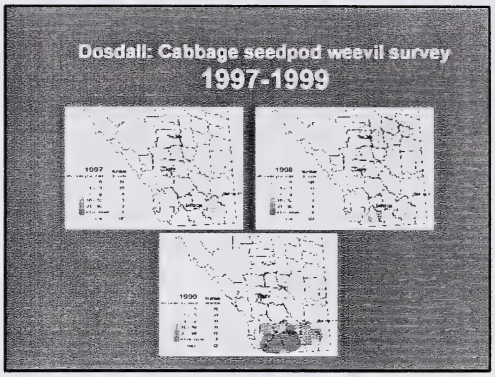
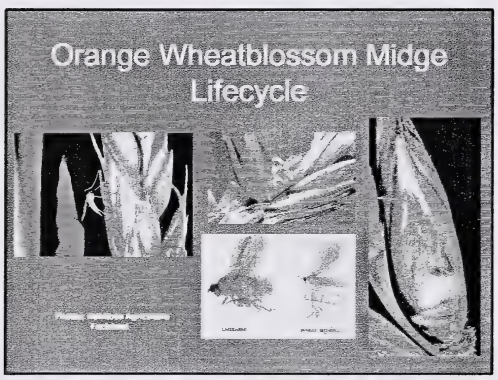
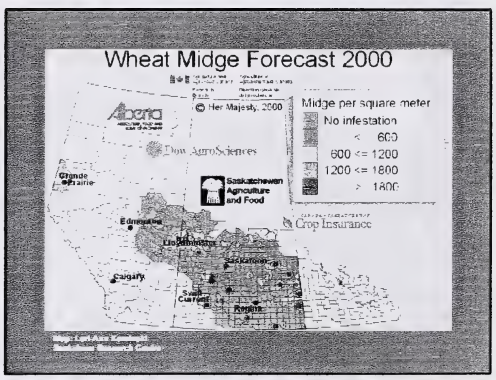


Photo: E. Kokko









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  - Westco
  - Dow Agrosciences
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  - AAFRD Staff: D. Seward, J. Huffman, R. Guillard, C. Yoder

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- Alberta Agriculture, Food and Rural Development
- Agriculture and Agri-Food Canada
- Dow Agrosciences, Aventis, Westco
- Peace Region Forage Seed Industry

Reducing Dependence on Herbicides

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Northern Agriculture Research Centre
Beaverlodge, Alberta

Reducing Dependence on Herbicides

J. T. O'Donovan. K. N. Harker and G. W. Clayton, Agriculture and Agri-Food Canada, Lacombe/Beaverlodge Research Centre; R. E. Blackshaw, Agriculture and Agri-Food Canada, Lethbridge.

Introduction

Reducing dependence on herbicides for wild oat management can have several advantages. These include reduced input costs, less likelihood of selecting for herbicide resistant wild oats, and more environmentally friendly weed management systems. Reducing dependence on herbicides can be achieved by adopting an integrated weed management (IWM) program. IWM essentially means the integration of several practices to reduce the negative impact of weeds on crops. This has been described as using several "little hammers" on the weeds rather than depending exclusively on one "big hammer" – a herbicide.

The approach to IWM can be long term, short term or a combination of both. The long-term approach involves adopting a systems approach to weed management such as the implementation of appropriate crop rotations, companion cropping etc. Such long-term systems approaches would be more appropriately titled "integrated pest management" (IPM) since the objectives of such systems will be to impact diseases and insects as well as weeds. A more short-term approach involves improving the health of a specific crop by adopting agronomic practices that enhance its competitiveness with weeds. This presentation will focus mainly on this short-term approach which should be considered as just one component of an overall IPM or ICM (integrated crop management) system.

Implementing IWM to reduce dependence on herbicides

1. *Adopt agronomic practices that give the crop a competitive advantage over the weed.*

a) Select a competitive crop and variety

Barley has been shown to be generally more competitive with weeds than other field crops grown in western Canada including wheat and canola. Several semi-dwarf and hull-less barley varieties have been developed in recent years. These varieties have desirable agronomic traits. Semi-dwarf varieties can be very appropriate for situations where lodging is a problem while hull-less varieties have less fiber and more digestible energy for livestock feed than hulled varieties. However, the shorter stature of the semi-dwarf varieties may render them less competitive with tall weeds such as wild oats. In addition, hull-less varieties have exposed embryos that can result in seed damage, and reduced seed germination and seedling emergence. Field experiments conducted at Vegreville and Lacombe showed that barley varieties could vary considerably in their ability to compete with wild oats. Overall, wild oat seed production, and yield loss were highest in the semi-dwarf, hull-less variety Falcon, and the semi-dwarf variety CDC Earl indicating that these were the least competitive with wild oats (Table 1). Poor emergence of Falcon, and the shorter stature of both Falcon and CDC Earl likely contributed to their poor competitiveness. The general-purpose varieties AC Lacombe and Seebe consistently

resulted in the highest yields and lowest wild oat seed production indicating that these were the most competitive with wild oats. These would be most suitable for IWM systems, or other low input systems such as organic farms.

Table 1. Barley yield loss and wild oat seed production in plots with different barley varieties at Vegreville. Means represent data averaged over 1997, 1998 and 1999.

Barley variety	Barley yield loss (%)	Wild oat seeds/m^2
Falcon	14	2380
CDC Earl	14	1380
AC Lacombe	5	800
Seebe	4	720

b) Select a crop-seeding rate to optimize yield and competitiveness.

Recommended crop seeding rates are often based on the results of experiments conducted under relatively weed-free conditions. Seeding crops at relatively high rates can improve competitiveness and reduce dependence on herbicides. In our experiments, regardless of barley variety, wild oat seed production decreased as barley seeding rate increased from 85 to 200 kg/ha (Table 2).

Table 2. Wild oat seed production at different barley seeding rates. Means represent data averaged over all varieties and years.

Barley seeding rate (kg/ha)	Wild oat seeds/m^2
85	2100
145	1260
200	880

c) Ensure rapid crop emergence

Crops that emerge ahead of weeds will have a major competitive advantage. Conversely, if the weed gets ahead of the crop, yield loss and weed seed production can be considerable. Our studies have shown that wild oats (20 plants/m^2) emerging 5 days ahead of barley will result in 17% yield loss compared to only 3% yield loss when the barley emerged 5 days ahead of the wild oats. Early crop emergence can be promoted by planting high quality seed at relatively shallow depths; and as soon as possible after the last tillage operation in a conventional system, or pre-seeding herbicide application in a reduced tillage system.

d) Place fertilizer to favor the crop - band rather than broadcast

Several studies have shown that increasing the nitrogen rate can enhance crop competitiveness over weeds, *provided that the nitrogen is banded.* In one study with continuous barley grown under zero tillage, green foxtail populations decreased from over 100 plants/m^2 where no nitrogen was applied to only 3 plants/m^2 where nitrogen was banded at 120 kg/ha. Other studies, however, have shown that when fertilizer is broadcast, weeds such as wild oats and green foxtail

can benefit more than the crop.

2. *Determine the nature and extent of the weed problem – is a herbicide application really necessary?*

a) Predicting yield loss

Scouting fields and assessing the nature and extent of the weed problem is an important component of IWM. Applying herbicides when they are unnecessary is a waste of time and revenue, and can lead to the development of herbicide resistant wild oats. Models have been developed that will help determine when wild oat control with herbicides is economical in barley, wheat and canola. The models base crop yield loss estimates on the wild oat density, the crop density, and the relative time of emergence of the crop and weed. The reliability of the models was evaluated in a number of farmers' fields throughout Alberta over the last three years. The relationships between actual and predicted barley yield losses and net economic returns are presented in Table 3 for nine barley fields. Barley plant density approximated 150 plant/m^2 in most of the fields. In most cases, the models provided reasonably accurate estimates of barley yield losses due to wild oats, and whether or not a profit or loss resulted from herbicide application. Herbicide application was uneconomical at the wild oat densities present in most of the barley fields. This is in contrast to wheat and canola fields where herbicide application was mostly economical (data not shown). The superior competitiveness of barley, coupled with its relatively low market price suggests that implementation of the "economic threshold" concept for wild oat management may be most feasible in barley.

Table 3. Actual and predicted barley yield losses due to wild oats, and actual and predicted profit or loss following wild oat control with a herbicide[a].

		% barley yield loss		$ profit (+) or loss (-) after wild oat control	
Wild oat Plants/m^2	Relative time of emergence (days)[b]	Actual	Predicted	Actual	Predicted
28	+4	1	7	-$40	-$24
9	+2	0	2	-$45	-$37
8	+5	0	2	-$45	-$38
12	Same time	13	7	+$11	-$14
22	+4	8	5	-$27	-$34
57	Same time	24	22	+$41	+$34
14	+4	4	4	-$25	-$25
13	+4	3	4	-$28	-$22
28	+5	6	7	-$28	-$25

[a]Assumes a barley price of $90/ton and a herbicide + application cost of $45/ha.

[b]Number of days preceded by + sign indicates barley emerged before wild oats.

b) Predicting wild oat seed production

Although herbicide application may not always be economical, many producers are reluctant to let wild oats and other weeds go to seed since this may exacerbate weed problems in future years. We have recently developed a model that will estimate wild oat seed production at different wild oat and crop densities in barley wheat and canola. The model is based on data collected from farmers' fields. Estimated numbers of wild oat seeds/m^2 produced by each uncontrolled wild oat plant growing in barley fields are presented in Table 4. It is evident that wild oat seed production is strongly influenced by barley plant density, and was considerably less at higher seeding rates. However, even at the highest seeding rate, a single wild oat plant can produce up to 70 seeds/m^2. This would be unacceptable to many producers. It should be kept in mind, however, that not all this seed would result in wild oat plants in future years. Some seed will end up as dockage, succumb to predators and a tillage operation or pre-seed burn-off, and an effective in-crop herbicide the following spring. More will remain dormant in the soil for many years, its impact possibly becoming "diluted" with time. It should also be kept in mind that wild oat populations in crop land in western Canada have not been decreasing in spite of extensive herbicide application; and that complete elimination of wild oat seed from the soil seed bank is probably an unrealistic goal.

Table 4. Estimated seed produced by one wild oat plant at different barley plant densities[a]

Barley plants/m^2	Estimated wild oat seed/m^2
100	100 - 170
150	70 - 115
200	50 – 90
250	40 - 70

[a]Based on 95% confidence intervals.

3. *Reduced herbicide rates*

Some herbicide labels recommend a range of rates depending on factors such as weed species present, weed density, soil characteristics etc. Producers are often tempted to reduce the herbicide rate below that recommended to reduce costs. This is not without risk. Recommended herbicide rates are usually based on the results of field experiments conducted across a range of soil and climatic conditions. Deviating from the recommended rate can result in loss of weed control as well as financial losses. Recent research reported in the scientific literature offers some guidelines on the conditions and circumstances under which reduced herbicide rates may be most efficacious on wild oats. The activity of low rates will be influenced by the nature of the herbicide, the extent of the wild oat infestation, the leaf stage at which the herbicide is applied, and even the time of day at which the herbicide is applied. Crop competitiveness will also be a major factor. Our research showed that improving the competitiveness of Falcon barley by increasing the seeding rate improved the activity of tralkoxydim (Achieve™) on wild oat seed production (Table 5). This is a good example of integrating herbicide application with an agronomic practice, and indicates that herbicide activity may be improved if the competitiveness and health of the crop is enhanced.

Table 5. Effect of tralkoxydim (Achieve™) and barley seeding rate on wild oat seed production.

Tralkoxydim rate (% recommended)	Barley seeding rate (kg/ha)		
	75	125	175
0	3260	2000	1000
25	340	140	20
50	120	60	20
100	12	7	2

Manure Agronomics Project

Tom Staples
Soil Management Specialist
Alberta Agriculture, Food and Rural Development
Falher, Alberta

Manure Agronomics Project

Year 2000 Preliminary Results

Tom Staples
Soil Management Specialist

Background

- Significant expansion of the livestock industry in the Peace
  - 2400 sows, 18,000 head feeder space in the Smoky River MD
  - Increasing interest in feedlot and ethanol production
- The Peace is gaining a new resource: Manure

Why is it a Resource?

- Nature's own slow-release organic fertilizer
- Contains many plant nutrients, including N, P, K, S, and many micronutrients
- The organic matter content is quite high and energy rich
- Improves soil tilth

Manure Nutrient Concentrations

	Moisture (%)	Total N (lb/tonne)	Total P_2O_5 (lb/tonne)	Total K_2O (lb/tonne)	Total S (lb/tonne)
Beef	50	22.0	12.1	17.7	2.64
Dairy	92	8.8	4.6	11.1	N/A
Hog	96	7.7	5.5	4.5	0.33
Chicken (layer)	60	35.2	61.4	22.2	N/A
Turkey	35	40.9	32.7	22.2	N/A
Sheep	50	15.4	10.1	27.5	N/A

N/A: Numbers not available

Crop Nutrient Use

Crop	Crop Part	N	P_2O_5	K_2O	S
Wheat	Seed	79	32	21	5
(48 bu/ac)	Straw	32	7	64	8
	Total	111	39	85	13
Barley	Seed	65	24	22	5
(60 bu/ac)	Straw	34	9	73	8
	Total	99	33	95	13
Oats	Seed	58	24	17	8
(84 bu/ac)	Straw	40	15	70	10
	Total	98	39	87	18
Canola	Seed	120	57	29	21
(57 bu/ac)	Straw	70	26	121	17
	Total	190	83	150	38

Estimated N Losses from Hog Manure during Application

Application Method	% of NH_4^+ Retained
Injection	100
Broadcast and incorporated within 24 hrs	85
Broadcast, no incorporation	65

From Bolton, 1999

Manure Injection

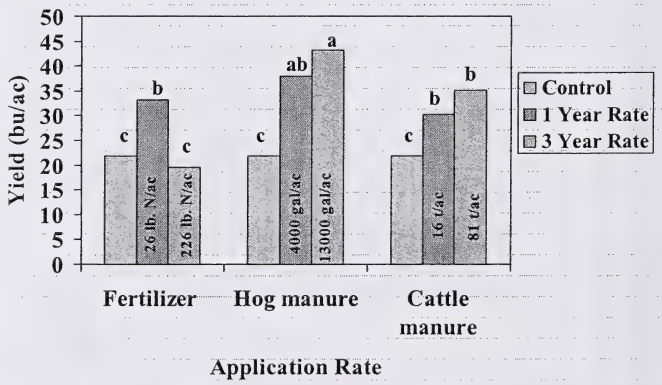
Objectives

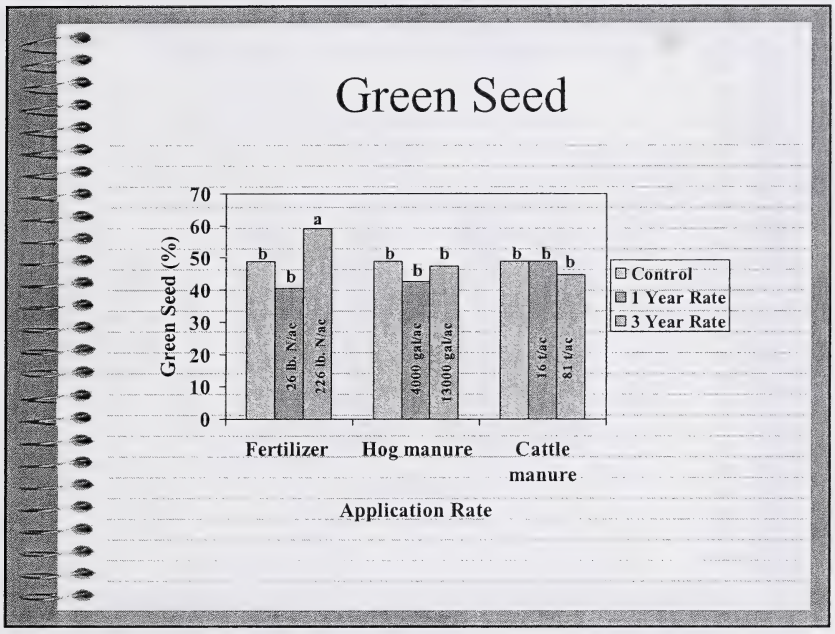
- Cattle and hog manure management:
  - 3-year application versus 3 one year applications versus inorganic fertilizer
  - N- versus P-based rates
  - Injection versus broadcast (hog)
  - Incorporation time (cattle)
  - Response to added sulphur

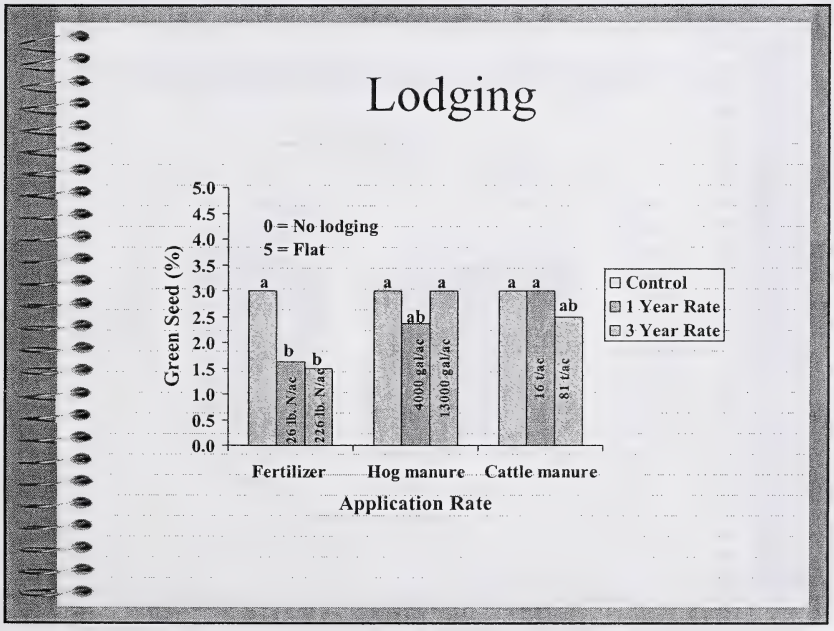
Project

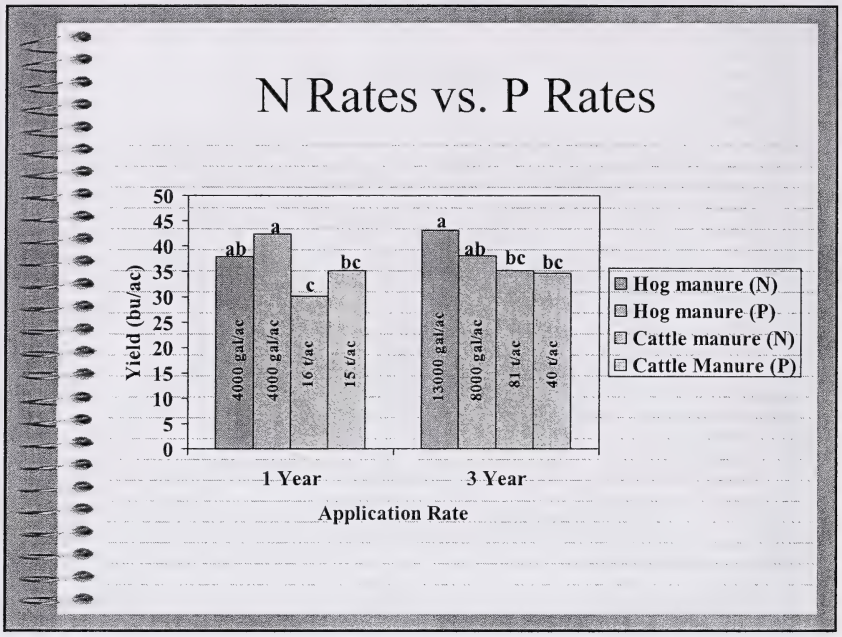
- Two sites (Falher and Fairview), RCBD, 18 treatments, 4 replicates
- Manure spread May 24 (cattle) and May 30 (hog), 2000
- Seeded June 1, 2000 to canola (46A76 at 7 lb./ac)
- Sprayed with Odyssey + Merge on July 8
- Harvested the day before it snowed

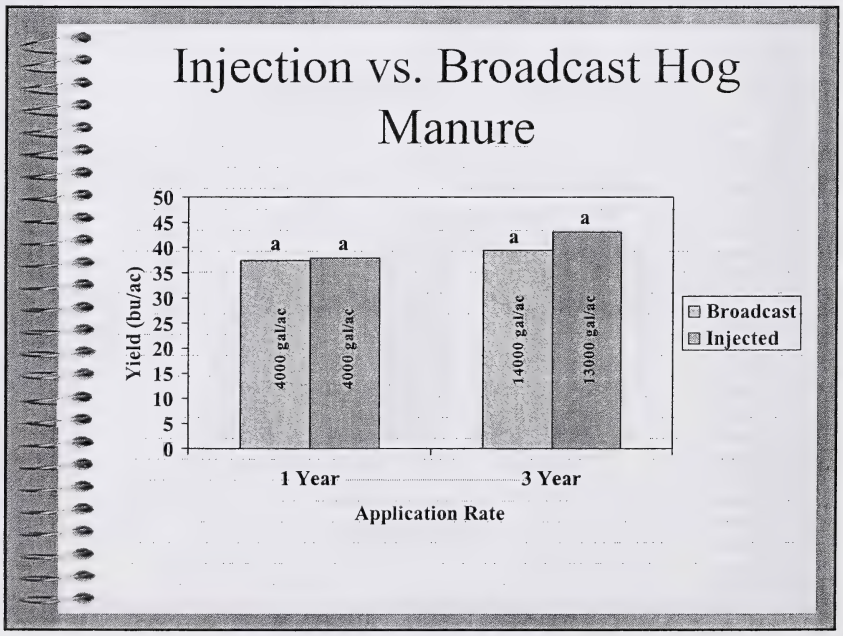
3 Year vs. 1 Year Rates

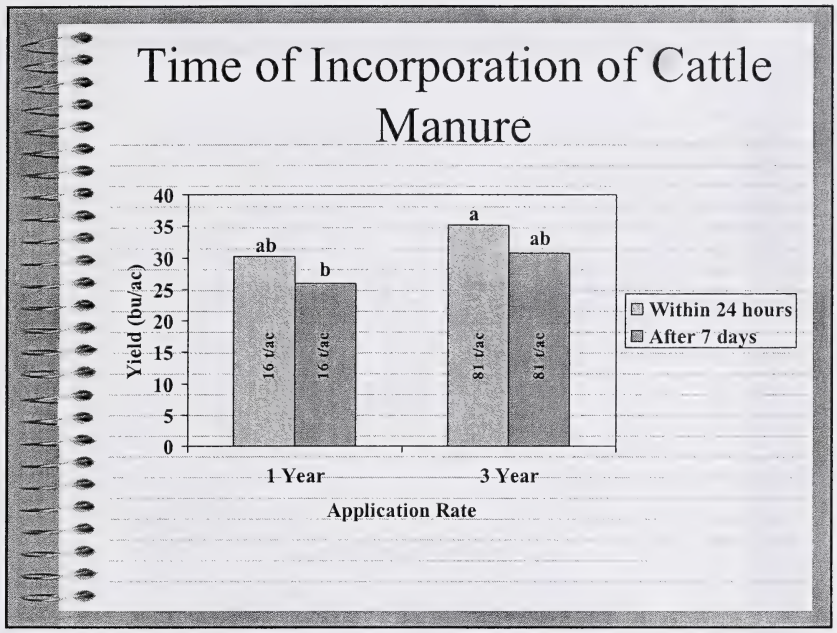


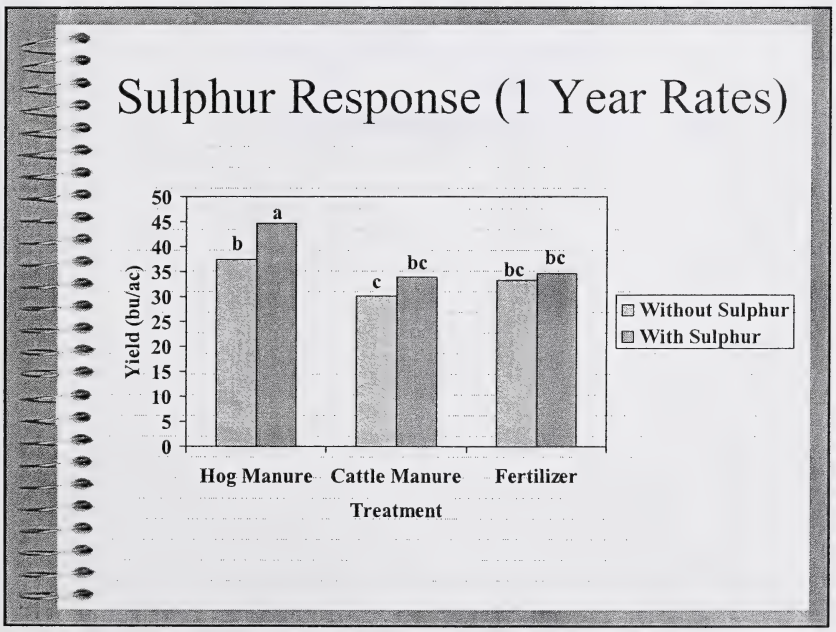

Green Seed
Green Seed (%)
70
60
50
40
30
20
10
0
b
b
a
b
b
b
b
b
b
26 lb. N/ac
226 lb. N/ac
4000 gal/ac
13000 gal/ac
16 t/ac
81 t/ac
Control
1 Year Rate
3 Year Rate
Fertilizer
Hog manure
Cattle manure
Application Rate

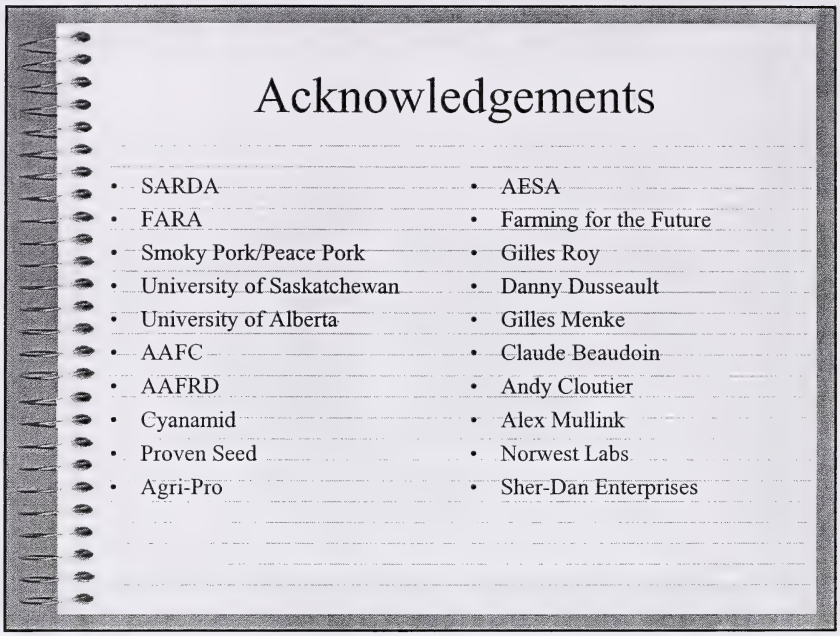

Lodging
Green Seed (%)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0 = No lodging
5 = Flat
a
b
b
a
ab
a
a
a
ab
26 lb. N/ac
226 lb. N/aq
4000 gal/ac
13000 gal/ac
16 t/ac
81 t/ac
Control
1 Year Rate
3 Year Rate
Fertilizer
Hog manure
Cattle manure
Application Rate


N Rates vs. P Rates
Yield (bu/ac)
50
45
40
35
30
25
20
15
10
5
0
ab
a
c
bc
a
ab
bc
bc
4000 gal/ac
4000 gal/ac
16 t/ac
15 t/ac
13000 gal/ac
8000 gal/ac
81 t/ac
40 t/ac
1 Year
3 Year
Application Rate
Hog manure (N)
Hog manure (P)
Cattle manure (N)
Cattle Manure (P)


Injection vs. Broadcast Hog Manure
Yield (bu/ac)
50
45
40
35
30
25
20
15
10
5
0
a
a
a
a
4000 gal/ac
4000 gal/ac
14000 gal/ac
13000 gal/ac
1 Year
3 Year
Application Rate
Broadcast
Injected


Time of Incorporation of Cattle Manure
Yield (bu/ac)
40
35
30
25
20
15
10
5
0
ab
b
a
ab
16 t/ac
16 t/ac
81 t/ac
81 t/ac
1 Year
3 Year
Application Rate
Within 24 hours
After 7 days


Sulphur Response (1 Year Rates)
Yield (bu/ac)
50
45
40
35
30
25
20
15
10
5
0
b
a
c
bc
bc
bc
Hog Manure
Cattle Manure
Fertilizer
Treatment
Without Sulphur
With Sulphur

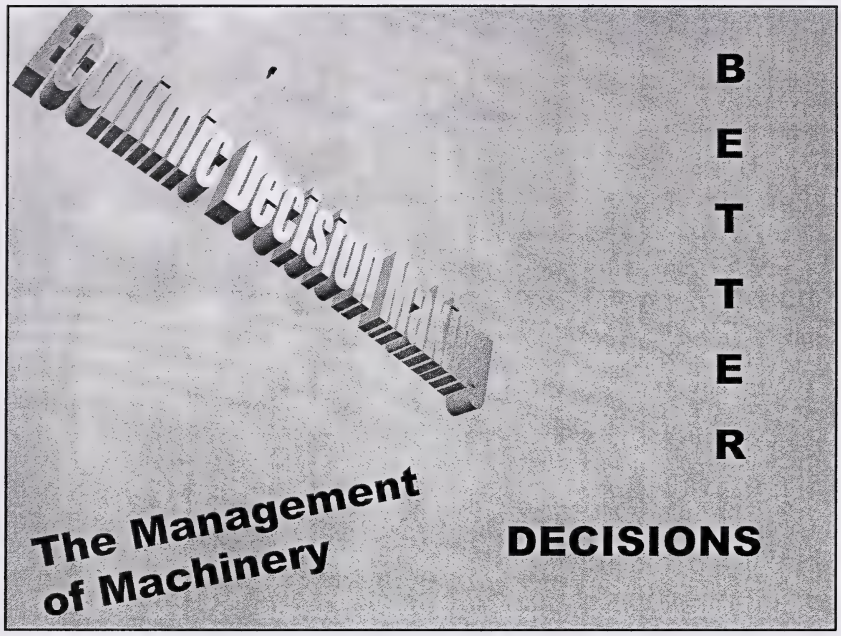


Acknowledgements

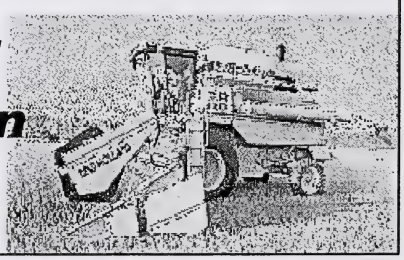
- SARDA
- FARA
- Smoky Pork/Peace Pork
- University of Saskatchewan
- University of Alberta
- AAFC
- AAFRD
- Cyanamid
- Proven Seed
- Agri-Pro
- AESA
- Farming for the Future
- Gilles Roy
- Danny Dusseault
- Gilles Menke
- Claude Beaudoin
- Andy Cloutier
- Alex Mullink
- Norwest Labs
- Sher-Dan Enterprises

Economic Decision Making

Gordon Williams
Farm Management Extension
Lethbridge Community College
Lethbridge, Alberta



The Fixed Assets of a Farm Business determine the farm's capacity and ability to earn profits.



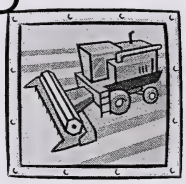
The Fixed Asset Decision is.....

- ✓ ***Chiseled*** in stone for often a decade or more.
- ✓ The Outlay of Cash
- ✓ The Possession of a Fixed Asset
- ✓ The Expectation of **FUTURE** benefits.

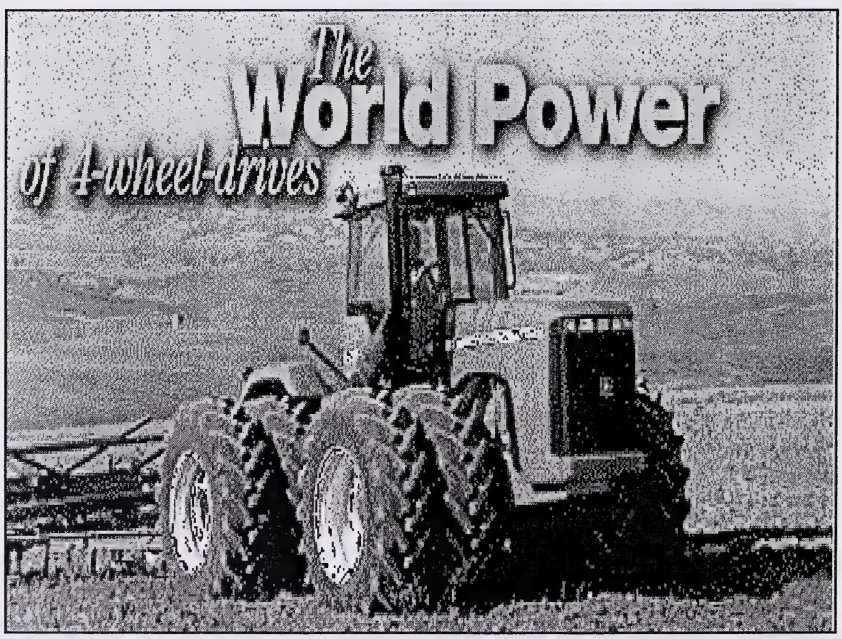
MACHINERY decisions are important because.....

- ✓ Difficult to reverse
- ✓ One decision may define the direction of the Farm
- ✓ More complex than EXPENSE decisions
- ✓ Determine the nature of the Farm's operating costs
- ✓ Asset Fixity- disposal for value

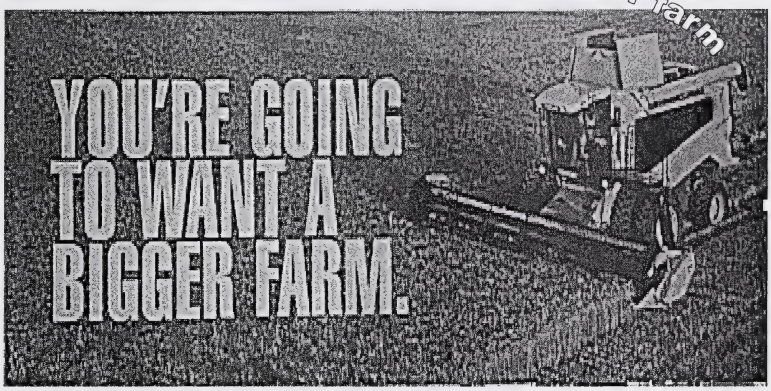
What makes up a "GOOD" Decision?



- A *systematic* approach.
- The recognition that "*TIME*" means money
  - Future benefits which deteriorate the further they are from the present
  - A method that allow comparisons of costs and benefits that occur at different times.
- A method of dealing with future uncertainty



Usually because you NEED a bigger farm



INVESTMENT MEASURE

- ✓The Larger the income ... the better
- ✓The Sooner the income ... the better

Pay back Method

- ***Will I get my money back?***

✓Does NOT satisfy criteria No 1.

✓Does NOT satisfy criteria No.2

Rate of Return

- ***How much will this earn me ?***

- Satisfies Criteria No 1.

- Does not satisfy Criteria No2.

Net Present Value Method

- The right way
- **Satisfies** criteria No 1.
- **Satisfies** criteria No. 2

NET PRESENT VALUE - *all elements in focus*

- ✓The amounts of future benefits and costs
- ✓Their timing
- ✓A percentage to *'DISCOUNT'* future sums to express their present value.

Machinery Cost Worksheet

Machinery Cost Worksheet	Power unit or self-propelled unit	Implement 1 Cropping Width	Implement 2
Field Operation			
Machine Description:	275 4wd	air drill	
Speed/Efficiency	5.00 MPH	50% Eff	
Width		40 ft	
A. New Price	$150,000.00	$ 105,000.00	
B. Planning Period(yrs)	12	15	
C. Used Price	$75,000.00	$ 10,500.00	
D. Annual Hours of use	400	150	
E. Fuel Usage(L. per hr.)	53		
F. Fule Cost ($ per liter)	$0.23		
G. Labor Cost ($per hr)			
H. Annual repair rate (%new price)	3.00%	3.00%	
I. Interest Rate (risk Free)	4.00%	4.00%	
J Risk Premium	6.00%	6.00%	
K. Marginal Tax Rate	0.00%	0.00%	
L. Rate Inflation	2.00%	2.00%	
M. CCA class rate	30.00%	20.00%	

INVESTMENT CRITERIA

Project Name:

Initial Investment
Down Payment
Amount Borrowed
Salvage Value
Ownership Period (years)
Loan Repayment Period
Annual Revenues
Years to
to
to

Marginal Income Tax Rate
Capital Gain Tax Rate
Before Tax Discount Rate
Loan Interest Rate
CCA Rate
% Available for Depreciation
Operating Expenses
Years to
to
to

Annualized Equivalency
Annualized Capital Cost
Net Present Value
After Tax Discount Rate
Internal Rate of Return

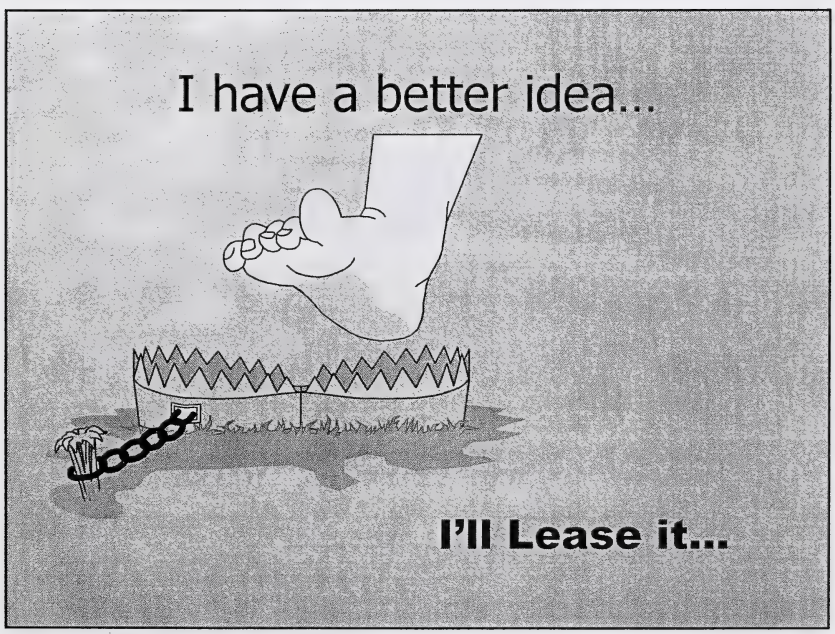
Years
Capital Recovery Period
Debt Recovery Period
Investment Recovery Period
After Tax Net Cashflow

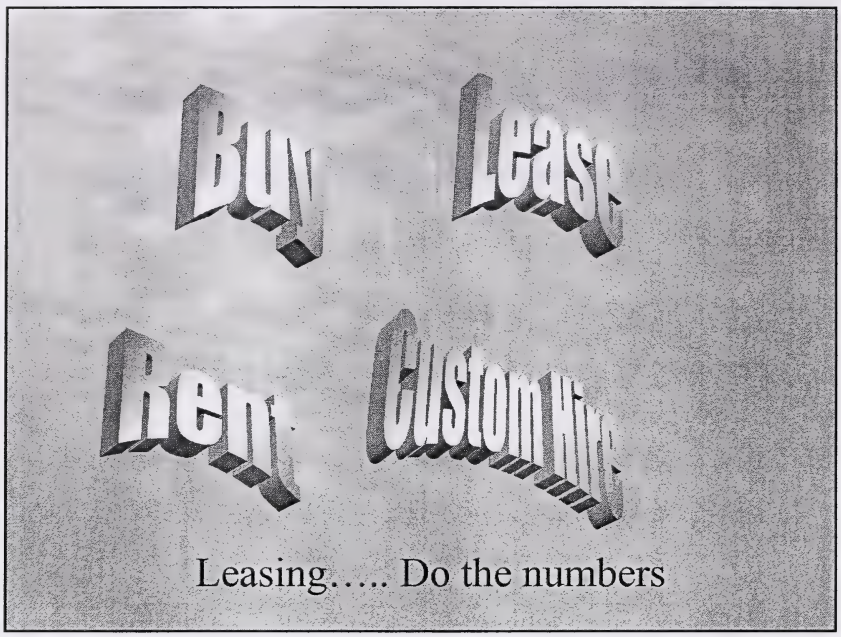
What do we want to see.....

1).Net present value above zero

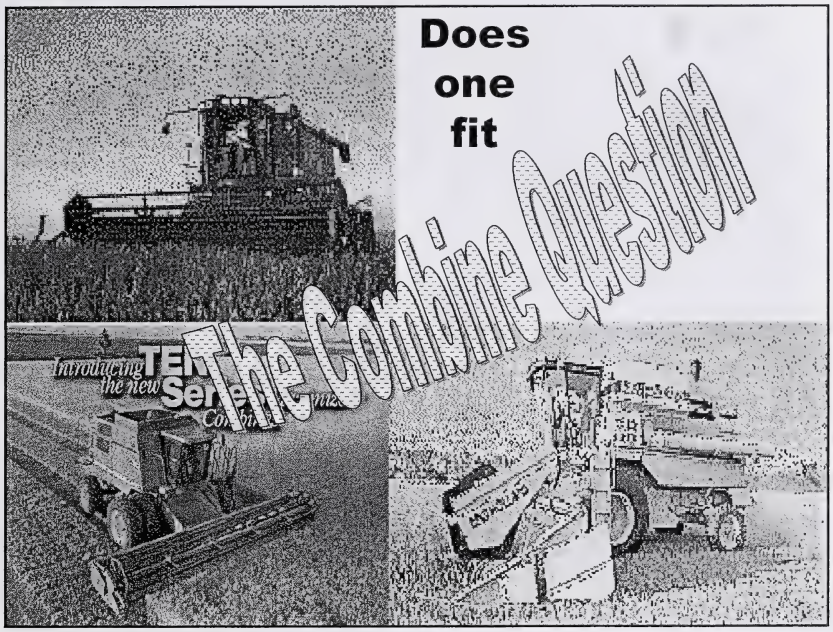
2).Internal rate of return above cost of capital

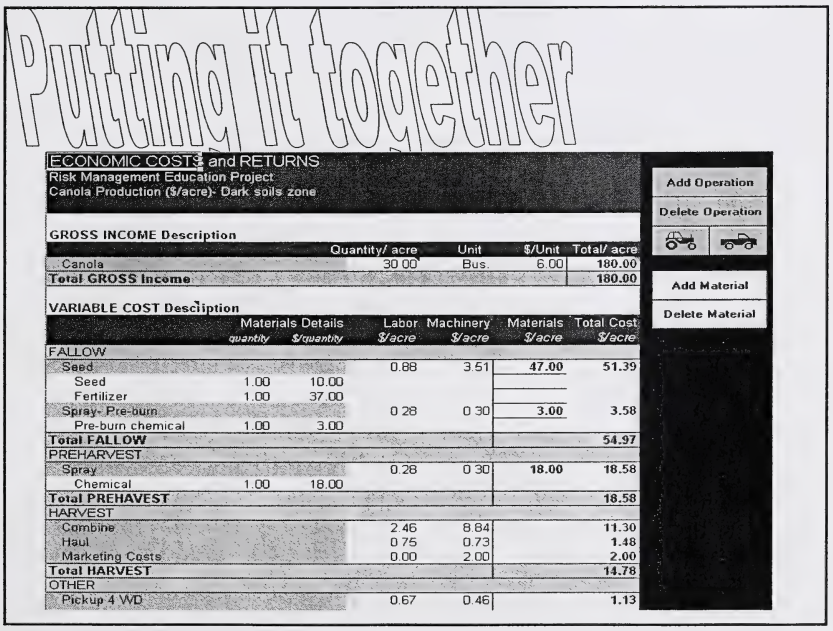
3).Debt recovery period less than Loan Repayment Period




Buy
Lease
Rent
Custom Hire
Leasing….. Do the numbers

To Replace or.....
Replace
Repair



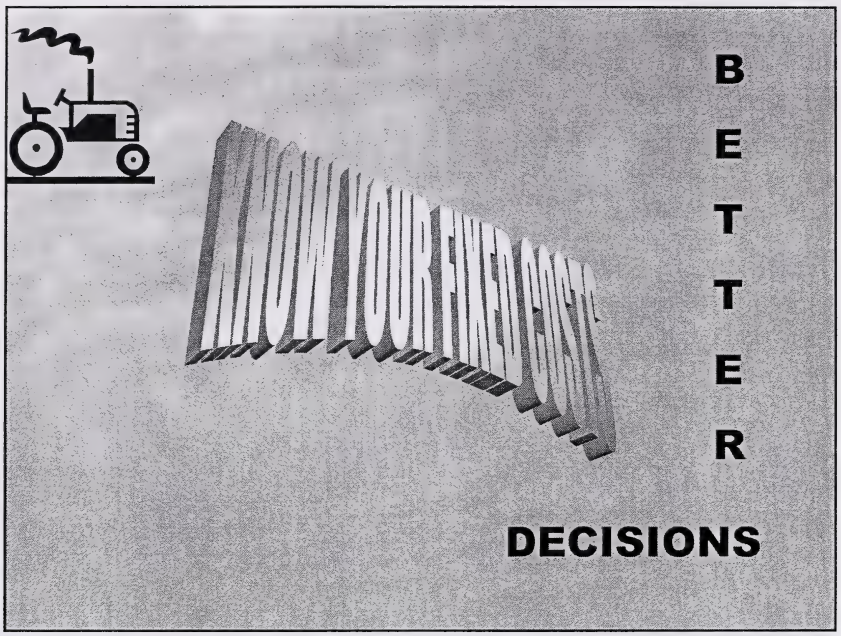


GROSS INCOME Description

	Quantity/ acre	Unit	$/Unit	Total/ acre
Canola	30.00	Bus.	6.00	180.00
Total GROSS Income				**180.00**

VARIABLE COST Description

	Materials Details quantity	Materials Details $/quantity	Labor $/acre	Machinery $/acre	Materials $/acre	Total Cost $/acre
FALLOW						
Seed			0.88	3.51	47.00	51.39
Seed	1.00	10.00				
Fertilizer	1.00	37.00				
Spray- Pre-burn			0.28	0.30	3.00	3.58
Pre-burn chemical	1.00	3.00				
Total FALLOW						**54.97**
PREHARVEST						
Spray			0.28	0.30	18.00	18.58
Chemical	1.00	18.00				
Total PREHAVEST						**18.58**
HARVEST						
Combine			2.46	8.84		11.30
Haul			0.75	0.73		1.48
Marketing Costs			0.00	2.00		2.00
Total HARVEST						**14.78**
OTHER						
Pickup 4 WD			0.67	0.46		1.13


KNOW YOUR FIXED COSTS
BETTER
DECISIONS

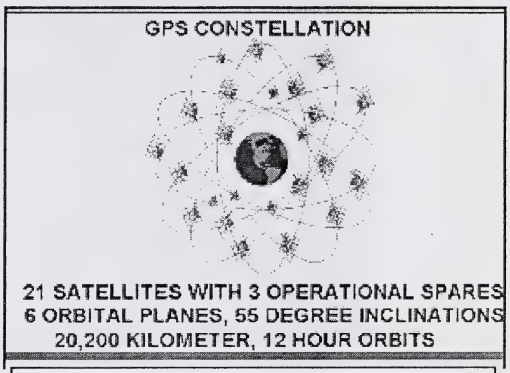
Precision Farming Update

Tom Goddard
Soil Conservation Specialist
Alberta Agriculture, Food and Rural Development
Edmonton, Alberta

Precision Farming Update

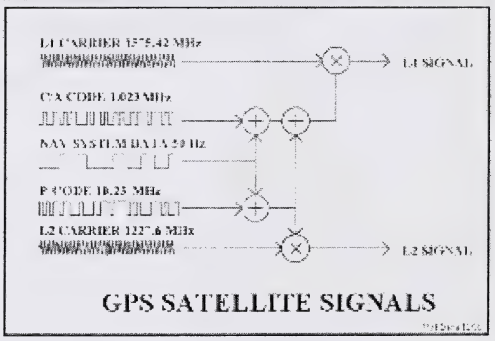
(2001 "Direct Seeding Ideas" Workshop, Falher & Fairview, January 2001)
Tom Goddard, Soil Conservation Specialist
Alberta Agriculture, Food and Rural Development
Email: tom.goddard@gov.ab.ca

GPS = Global Positioning System
NAVSTAR = NAVigation Satellites with Timing And Ranging (USA version)


GPS CONSTELLATION
21 SATELLITES WITH 3 OPERATIONAL SPARES
6 ORBITAL PLANES, 55 DEGREE INCLINATIONS
20,200 KILOMETER, 12 HOUR ORBITS

The NAVSTAR GPS :
The "space segment" consists of the orbiting satellites. The "ground segment" consists of 5 monitoring stations around the world including the master control station at the Falcon AFB, Colorado Springs.

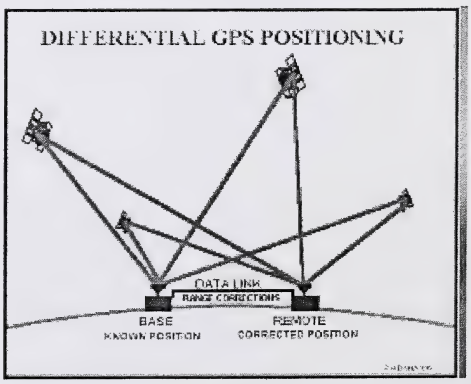
Satellites broadcast a continuous signal on two frequencies (L1=1575.42MHz, L2=1227.6MHz). Military class positioning uses both frequencies. Civilian use is L1 frequency although the L2 can be used to increase accuracy by calculating the carrier phase of L2.



Signal carries a binary code with specific sequences that can be recognized by the GPS receiver.
Each satellite has two atomic clocks that provide precise timing (accurate to a billionth of a second).

GPS uses the binary code and the timing to calculate the distance from the GPS receiver to the satellite. Need a minimum of 4 satellites in solution to solve for the ambiguities in position and timing.

Main sources of error are the Selective Availability that was introduced by the military to "scramble" the signal. This was removed in 2000. The other large source of error remains - the ionosphere (upper atmosphere).



Differential GPS uses a base station over a known position to correct the errors from selective availability (no longer an issue), the ionosphere, etc. The difference error (x,y,z) for each second in time is used by the remote or rover GPS to calculate it's correct position for that same second.

GPS receivers can solve for the cycles of the carrier wave of the GPS information ("resolution of carrier phase ambiguities"). The wavelength is about 19.7 cm so we often see GPS receiver accuracy as 20 cm.

(graphics on this page from Peter H. Dana, The Geographer's Craft Project, Department of Geography, The University of Colorado at Boulder http://www.colorado.Edu/geography/gcraft/notes/gps/gps_f.html)

Turning off Selective Availability (SA) has eliminated the cost of using differential corrections to get medium accuracy positioning.

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release May 1, 2000

STATEMENT BY THE PRESIDENT REGARDING THE UNITED STATES' DECISION TO STOP DEGRADING GLOBAL POSITIONING SYSTEM ACCURACY

I tested a Garmin III handheld GPS receiver for accuracy in Edmonton late on May 1 and the morning of May 2, 2000. The expected position error (EPE) was plus/minus 20 to 30 meters on May 1. After SA was turned off the errors dropped to plus/minus 3 to 6 metres.

Date	Local Time	Satellites	EPE (+/- m)	DOP	Satellite geometry
May 1	1700	8	18	1.1	V.Good
May 1	1745	7	21	1.4	Fair
May 1	2112	6	30	2.2	Poor
May 1	2150	7	20	1.4	P
May 1	2235	7	18	1.3	P
May 2	0800	7	5	1.2	F
May 2	0730	9	3	0.8	VG
May 2	0848	6	5	1.1	F
May 2	1030	6	6	1.8	P

GPS error budget with and without SA.

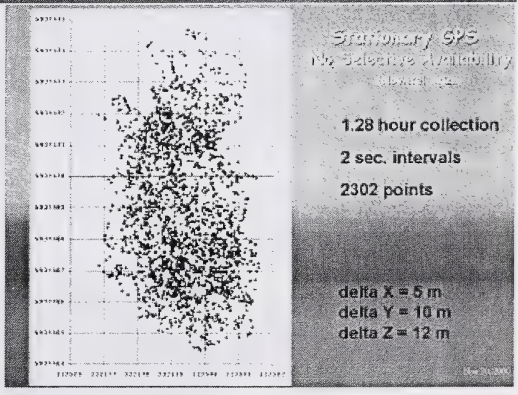
Differential corrections are still needed to get around the ionospheric errors, multipath, etc in order to obtain sub-metre accuracies.

GPS Error Budget

Error Source	Typical Range Error (m, 1sigma)	
	SPS w SA	SPS
Selective Availability	24.0	0.0
Ionosphere	7.0	7.0
Troposphere	2.0	0.2
Clock & Ephemeris	2.3	2.3
Receiver Noise	0.6	0.6
Multipath	1.5	1.5
Total User Equivalent Range Error (UERE)	25.0	7.5
Typical Horizontal DOP	1.5	1.5
Total Stand-Alone Horizontal Accuracy, 95%	75.0	22.5

Stationary GPS collecting data for 1 hour, 17 minutes shows the "shotgun blast" error pattern now as opposed to the "wandering path" error pattern with SA on. Accuracy is worse in a north-south direction because of the equatorial bias of the GPS satellite orbits.

Current stated accuracy of single point GPS is 20 meters (horizontal).



FUTURE:

1) Wide Area Augmentation System (WAAS) will be the application of GPS and DGPS for civilian aircraft navigation. It is installed and being tested now.

2) The USA will be adding another frequency (L5) to the GPS signal. This will increase accuracy and reliability but it will be 5 years or more before this is useful.

GPS Summary

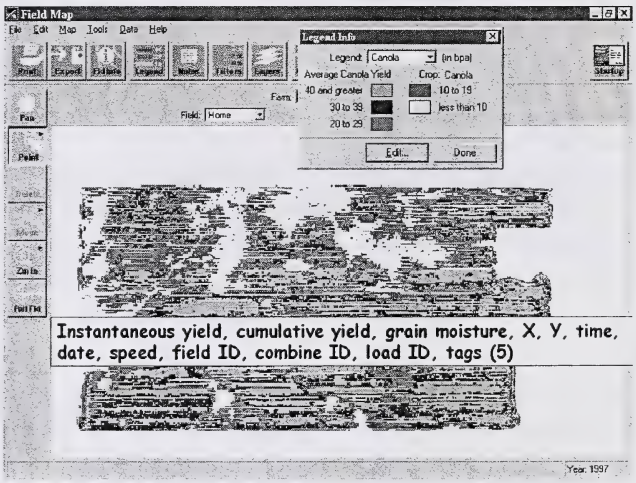
- GPS is world-wide, 24 hr, 365 days/yr
- Need unobstructed view of SVs
- GPS gives real-world position and time/date
- GPS is free, DGPS costs
- Position accuracy can be <20m to <1cm at sub-second freq.
- GPS equipment ranges from $180 to $30,000
- Differential GPS needed for guidance, precise location

Applications of GPS in precision farming systems.

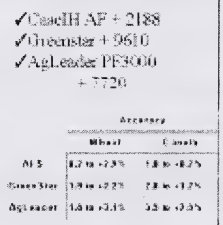
GPS can be used for

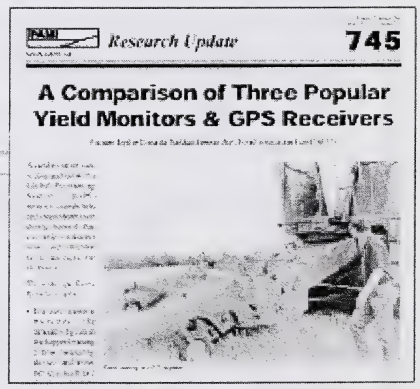
Yield mapping
Weed mapping
Variable rate applications (fert, seed, spray)
Guidance

Yield mapping is a good place to start. Yield monitors are available to put on any type of harvester for any type of crop.


Field Map
Legend Info
Instantaneous yield, cumulative yield, grain moisture, X, Y, time, date, speed, field ID, combine ID, load ID, tags (5)

Prairie Agriculture Machinery Institute (PAMI), Humbolt, did a test of three makes of yield monitors a couple of years ago. The report is available free in an electronic form (PDF) from their website. Accuracy was generally in the +/- 2% range for all makes.

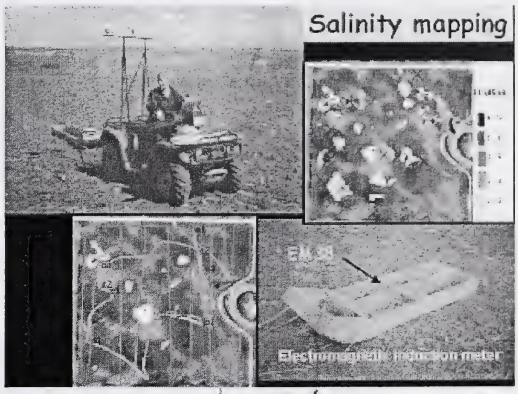




http://www.pami.ca

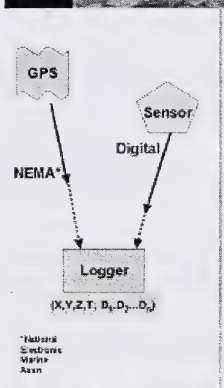
GPS can be hooked up to many types of sensors and equipment.

An EM38 meter will measure salinity to the 4 foot level as the sensor slides over the ground (in a toboggan). The electronic output from the EM38 can be coupled to a Differential GPS to provide spatially referenced salinity measurements. Then a salinity map can be made.



A first cousin of the EM38, the EM61 is now rigged with a datalogger that couples the EM61 output with GPS data.

Any sensor of any kind that provides a digital output signal can be coupled with a GPS signal to get position and time of any particular sensor reading. The possibilities are endless.



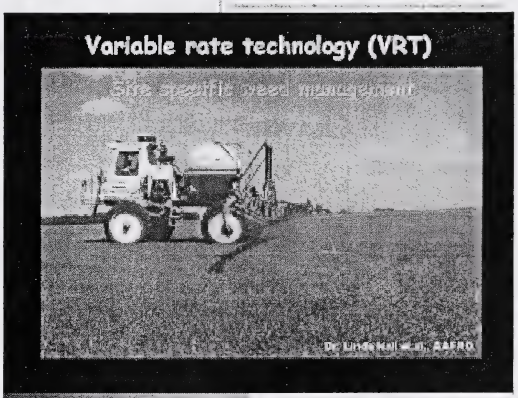
Weeds can be mapped with GPS while combining, seeding or other operations.

Sprayers can now turn on and off with commands from a GPS/computer.

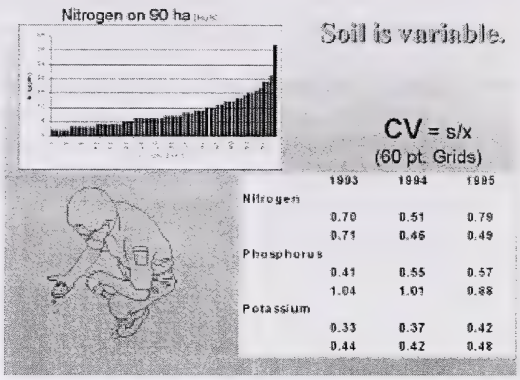
Spray only where weeds are.
Spray appropriate rates for weed, soil.
Watch for uncontrolled, resistant weeds (reoccurring on maps)

Guidance systems are quite popular now. Conventional markers (foam) are hard to see in direct seeding conditions (tall stubble), at high speeds and in low light conditions. Newer guidance systems now incorporate curved-line guidance (parallel guidance around sloughs, obstacles) and colour screens.

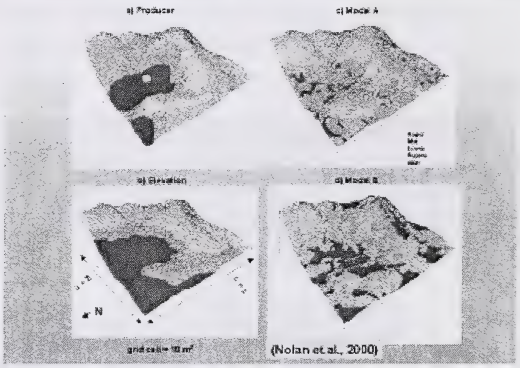
More and more machinery manufactures are promoting equipment that is "precision farming ready" – variable rate controller options.



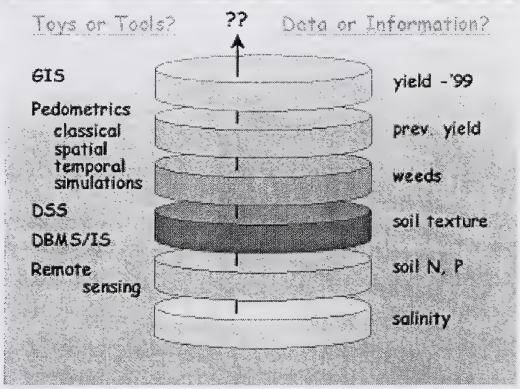
Soil fertility is very variable across a field. We have demonstrated this in grid sampling over different fields in different years. Nitrogen can vary 50 to 80%, phosphorus by 50 to 100%. This underlines the importance to use some sort of benchmark sampling strategy in order to remove the spatial error from your fertility analysis. Agronomists are now using handheld GPS to do point-composite sampling of soils at important/representative points in a field.



In Alberta we have pioneered the landscape based thinking of site specific agriculture. Soil processes vary by landscape so therefore, soil properties can vary by landscape. This is now being picked up in other countries as a tool for developing management units within fields. We have found that fertility varies by landscape position as well as the magnitude of soil processes such as nitrogen mineralization (nitrogen supplying power).



Precision farming is a process of collecting more specific information of your production practices, inputs and outputs. Then the issue is the conversion of that additional data into information useful for farm management.



Summary

- ✓ Technology is marching on.
- ✓ A whole lot of yield mapping going on.
- ✓ Are we creating information or data?
- ✓ Beyond gee whiz?
- ✓ Feedback we've never had.
- ✓ Learning and adoption is in steps.
- ✓ (mapping, guidance, rethinking agronomy)
- ✓ Manage cows and acres not herds and farms.
- ✓ PF is GMO, PI and environmentally friendly.
  (GMO = genetically modified organism, PI = product identity tracking)

Tillage and Time, Seeding Depth, Drill Selection and Lodging

Garry Ropchan and Tracey Nicholson
Central Peace Conservation Society
Spirit River, Alberta

TILLAGE and TIME, SEEDING DEPTH, DRILL SELECTION and LODGING

CENTRAL PEACE CONSERVATION SOCIETY, SPIRIT RIVER, ALBERTA

BY: GARRY ROPCHAN and TRACEY NICHOLSON

A Selection of Plot Results To Study:

The effect of conservation tillage after seven years.
Does seeding depth make a difference?
Does seed drill selection make a difference?
When can too much fertilizer be a "downfall"?

ACKNOWLEDGMENTS

The success of the Central Peace Conservation Society requires the combined efforts of many individuals and groups. I wish to recognize the following groups and individuals.

Alberta Environmentally Sustainable Agriculture (A.E.S.A.)

BIRCH HILLS COUNTY: Council, Ag. Service Board and staff

SADDLE HILLS COUNTY: Council, Ag. Service Board and staff

M.D. #133: Council, Ag. Service Board and staff

Monsanto, Ultrabred Seed, Proven Seed, Adventa Seed, Aventis, Syngenta, Dow AgroSciences, Bayer, Agricore, United Grain Growers Ducks Unlimited, Western Co-operative Fertilizers Ltd., Norwest Labs

ZERO TILL AFTER SEVEN YEARS

- Prior to 1994 CPCS was renting a seed drill for producers to use. There were some methodology problems.
- While most of the drill renters were willing to participate in the new protocol, two producers did understand the need for the changes, Bill Mortland and Otto Toerper.
- Over seven years we have had some bad weather (1996 and 1997) and I only have results from all seven years for Otto's plot.

Garry Ropchan, Research Coordinator, Central Peace Conservation Society (CPCS), Spirit River

- The purpose of conducting these tillage comparison plots was to determine if conservation tillage practices could be successfully adopted by producers from the Central peace region.
- One concern was that many of the problems caused by tillage to a soil (OM loss, poor tilth, baking/crusting, water ponding) are not corrected immediately after adopting a conservation seeding system. Improvements to a soil, unlike damage, is slow to occur.
- We were also interested in looking at the long term performance of different tillage systems.

- Plot history - Otto had his first exposure to zero till in the late 1980's. He had a 20 acre field north of his house and so they divided the field in two and seeded 10 acres into stubble and 10 acres into tilled ground.
- A neighbour with a Flexicoil 5000 Airdrill with single shoot openers custom seeded Otto's whole farm as well as this plot.
- The problem arises in how the plot was evaluated. Both 10 acre pieces were harvested separately and weighed. You end up comparing yields taken from parts of the field that can be separated by 800 feet. This can mean comparing crop performance from different soil types which makes doing an evaluation very difficult.

- The normal procedure for this type of plot is to do a paired T-test. You walk down the boarder of the plot and collect the crop from a 1/4 meter area on each side of the boarder. Then repeat this 15 times.
- Take your 30 gunny sacks of grain and then you have to hand thresh them out. You can get yield data, but it is a very difficult and time consuming operation.
- From 1995 on the plot format was changed. I wanted to look at three different tillage systems, ZT, MT and CT.

- The ZT would only receive an application of Roundup prior to seeding, the MT was cultivated one and harrowed once and the CT was cultivated twice and harrowed twice. The tillage passes were always made in the spring.
- Each of the three tillage systems was seeded three times in the plot so we had a total of 9 strips to weigh at harvesting time.
- The entire plot was also seeded using the same drill on the same day, same seed and fertilizer rates etc.

- What did we observe?
- Remarkable differences in soil moisture, dust, crop stress, crop growth, weediness and yield.
- The ZT always had better soil moisture than the MT and CT. This was noticed both upon arriving at the field, during the seeding operation and after rainfall.

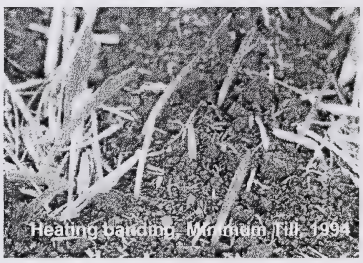
- The dustiness during the seeding operation was always lowest on the ZT - effecting visibility and machinery wear and producer moral.
- Turning on untilled soil was very easy where as turning on tilled ground was more difficult, the wheels tended to plow straight ahead rather than to steer the tractor.

Zero Till, 1994

Minimum Till, 1994

- In 1994 when walking the plot I found many plants that had areas of yellow on the leaves. I noticed that this was only occurring on part of the plot. It was only on the plants that were seeded into the tilled ground.

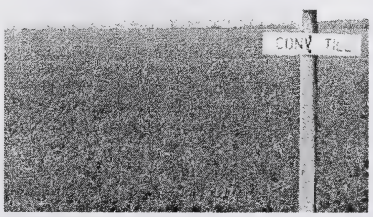
- This turned out to be a phenomena called “heat banding”.
- Heating banding occurs when the maximum and minimum changes in temperature in great. The lack of stubble in the tilled area meant that the top of the soil was getting very hot during the day and was getting cooler at night.
- Tilled soil does not have the protection of the stubble to insulate it and moderate temperature changes.

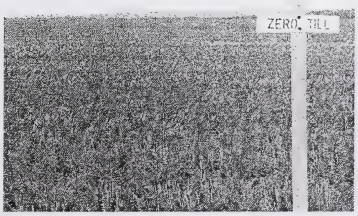

Heating banding, Minimum Till, 1994

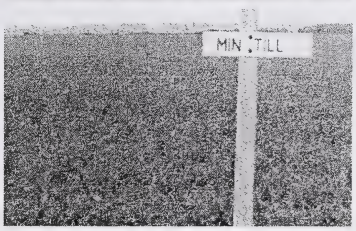
- As the plot started getting older we started to notice some differences in crop growth. The ZT crop was often found to be thicker and taller than the other two seeding systems. This was especially noticed in 2000 when we actually took crop height measurements.

✦	Zero Till	39.4" a
	Minimum Till	35.2" b
	Conventional Till	34.0" b

- Producers have often expressed concerns about weed problems being greater in ZT than in other tillage systems. This does not seem to be what we have observed at the Toerper site.



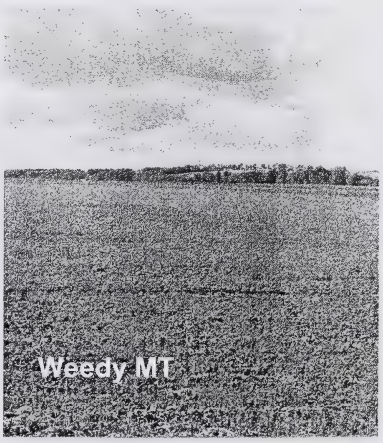




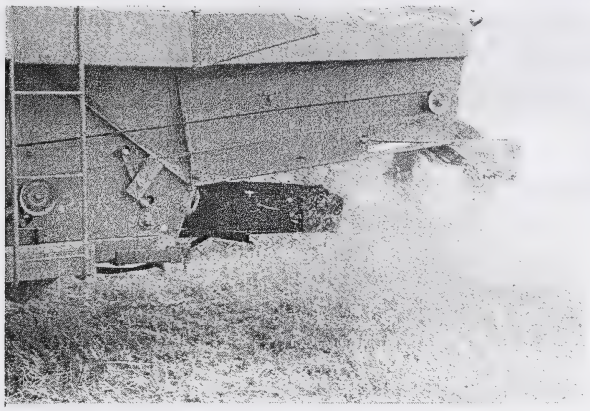
- Field peas and narrow leafed Hawk's beard, 1995

- We continue to observe that ZT may be playing a role in reducing some weed problems that we have to deal with.

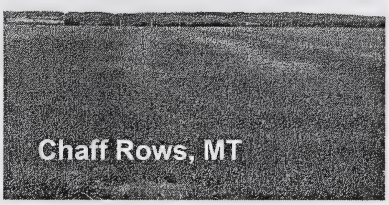
- Dandelions and NLHB seem to be doing a bit better on the MT than the ZT.



- Handling crop residue is going to impact your success in adopting zero till.
- Very early on Otto mounted a chaff spreader in his I.H. 914.



- As with all mechanical devices, one year it decided that it was going to stop working. We were lucky in that we were able to finish one complete rep of the plot, but the next year we saw some interesting things.



- It seems that ZT does offer some benefits over other tillage systems, but what about actual performance? What have we found?

Year Crop	Tillage System	Yield Bu/ac*	% Dockage*	Cont. Marg.
1994 Barley	ZT	58.6a	0.7a	+24.00/ac
	MT	50.6a	0.1 b	
1995 Peas	ZT	33.3a	2.8a	+30.00/ac
	MT	27.0a	4.0a	
	CT	14.9a	4.0a	
1996 Wheat	ZT	25.8a	0.8a	-6.50/ac
	MT	28.0a	1.0a	
	CT	28.4a	1.0a	

Year Crop	Tillage System	Yield Bu/ac*	% Dockage*	Cont. Marg.
1997 Canola	ZT	11.7a	30.0a	+21.00/ac
	MT	9.1a	37.2a	
	CT	10.2a	32.7a	
1998 Barley	ZT	72.2a	1.0a	+25.42/ac
	MT	59.3 b	0.5a	
	CT	58.5 b	0.5a	
1999 Pea	ZT	11.0a	3.2a	+4.78/ac
	MT	10.4a	4.1 b	
	CT	10.3a	4.2 b	
2000 Wheat	ZT	53.0a	1.0a	$11.50/ac
	MT	49.7 b	1.0a	
	CT	46.5 c	1.0a	
		Average Contribution Margin		$15.75/ac

- Changes in soil quality. Benefits from zero till like increased OM, nutrient cycling, water movement etc. can take up to five years to occur.
- After six years we collected samples from each of the different tillage sites and had them tested.

Treatment	%OM	pH	EC	N	P	K	S
CT	4.7	6.2	0.36	68	53	360	41
MT	4.2	6.1	0.34	59	51	367	40
ZT	4.6	6.0	0.42	69	50	420	43

- Not a lot of differences. The fertilizer recommendations for a 40 bu wheat crop were interesting:

Treatment	N	P	K	S	Cost $/ac
CT	44	10	15	0	17.82
MT	51	11	15	0	20.14
ZT	42	12	0	0	15.62

- In 2001 we may sample each of the nine strips individually and have them tested.

Effect of Fertilizer on Crop Lodging

- Background-Peace region soils have lost a good portion of their organic matter-this leads to problems in crop production - lower water holding capacity, reduced infiltration rates, less nutrient supplying ability etc.
- Organic matter can only come from one source, decayed plant materials.
- Zero till, which reduces the rates at which organic matter is oxidized at can promote organic matter levels to increase.
- I wondered about other methods of increasing OM levels since OM increases through ZT can take a fair time to occur. It would seem reasonable that increasing the amount of plant material available would also be a good technique for increasing OM levels.
- I was also curious about another aspect. What impact does the fertility management have on soil over the long term?

- Does a high level of fertility management increase yields in an economic fashion and also improve the soil quality over a less aggressive fertility program?
- A site to study this question was established in 1999 west of Eaglesham. The soil sample taken found:

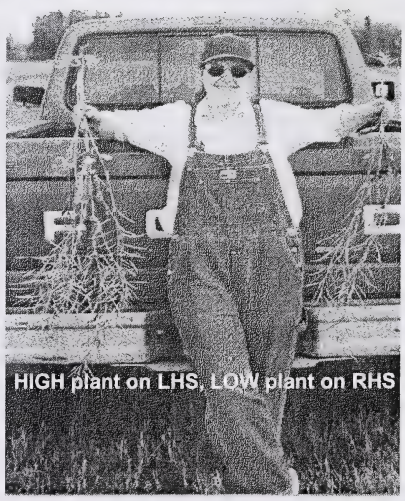
OM	pH	N	P	K	S
3.5%	6.2	68	18	370	68

- The fertilizer recommendations for a 35 bu canola crop was:

N	P	K	S
68	36	15	0

- Three rates of fertilizer were applied:

LOW	49-26-11-0	20.9a bu/ac	CM-$99.52/ac
MEDIUM	73-39-16-0	25.3b bu/ac	CM-$113.25/ac
HIGH	88-46-19-0	37.0c bu/ac	CM-$175.87/ac



- We continued on in 2000 and laid the same fertility treatments in the same location they were placed in 1999.
- In 2000 we took individual samples from each of the plots but these have not been tested yet ($$$).
- The soil sample taken found:

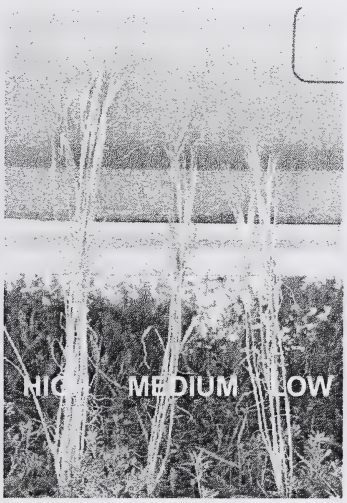
OM	pH	N	P	K	S
N/A	6.5	94	28	341	70

- The fertilizer recommendations for a 60 bu barley crop was:

N	P	K	S
21	26	15	0

- Three rates of fertilizer were applied:
- LOW 16-19-11-0 74.2 bu/ac gross
- MEDIUM 24-28-17-0 82.3 bu/ac gross
- HIGH 66-77-46-0 81.2 bu/ac gross

- Yields were good, but the yield response was poor. Why?
- Crop development during the growing season was very good.



- Plant development seemed to favor the HIGH rate over the others.
- Producers on the tour were very impressed with the HIGH rate.
- The rate was not chosen for any particular reason. In the past, for the HIGH rate I simply opened the drill up to its maximum.
- Applying three times the amount of N called for by the soil test may have proven to be my error.
- The very high rate of P may also have some role, again being two to three times the rate that most producers would have applied.

- The heavier crop was not able to stand up and it lodged!
- Swathing was very slow and difficult on the HIGH rate compared to the other two rates and even when combining the pickup belts were frequently slipping while trying to pick up the weight of the swath.
- Our second goal, increasing soil OM levels may still be helped by the greater volume of plant matter that was produced, but certainly exceeding the soil test by such a large margin was not effective.
- The samples have not been processed yet so we are also waiting to see the effect of the fertilizer rates on bu weight and 1000K weights.

- Conducting a soil test is a good idea and following the guidelines fairly closely is a better idea than pushing the yield envelope too far!

Effect of Seeding Depth In Zero and Minimum Tillage Systems

- Why should seeding depth be a concern?
- Crop growth depends on exposure of chlorophyll in plant tissues to sunlight.
- Longer the emergence time the more the seed is dependent on food stored in kernel itself, get the plant above ground and it can start to produce its' own food.
- One study (Hucl and Baker, 1990) studied the effect of seeding depth and found that by seeding wheat at 2.5" time to emerge was 7.5 days while wheat seeded at 1.25" emerged in 5.9 days. % germination was also found to be 72% at 1.25" depth compared to 70% at 2.5" depth.
- The emergence of the first tiller occurred in 10.6 days if seeded at 1.25" compared to 11.1 days if seeded at 2.5".

- Why are producers seeding too deep?
- Desire to seed into moisture. But....
- In direct seeding moisture is usually very close to the soil surface.
- How about the the Avadex factor?
- Avadex had to be tilled in and incorporated to the two inch depth. Wheat seed had to be planted BELOW the Avadex layer or you could be looking for problems.
- So maybe deep seeding, like excessive tillage, is done out of tradition.
- Risks of deep seeding-delayed emergence, increased disease damage, less competitive with weeds, increased draft (more horsepower needed)
- Risks of shallow seeding-germination problems if too dry

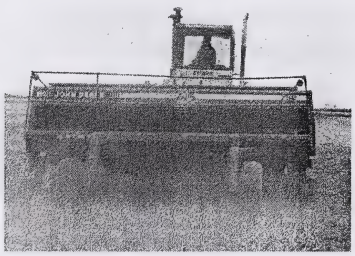
- 2000 Trial - seeded 1 and 2 inch depths under ZT and MT
- Burnoff (0.67l/ac RT and 0.67 l/ac AS, 5gal/ac) applied on May 21st, MT tillage passes with vibrashank on April 30th and May 26th.
- Seeded May 26th with Haybuster 8000 drill. 120 lb/ac Teal HRS wheat.
- Soil test found 93-28-372-62 in soil and recommended 19-26-15-0 for a 40 bu crop
- we applied 20-20-17-0 deep banded at time of seeding.
- crop looked good during the summer and no visual differences were observed during the growing season.
- It was swathed on Sept 9th as it was starting to lodge and combined on Sept 14th.

Treatment	Yield bu/ac
average 1"	61.6a
average 2"	60.7a
average ZT	61.4a
average MT	60.9a

- There are some small economic benefits to seeding shallower and seeding ZT.
- Thoughts on moisture in 2000.
- MT was certainly drier than ZT at time of seeding. First major rainfall occurred on June 5th, 0.7", after crop emerged, total rainfall during season was 16.25"

Zero Till Drill Equipment Comparison

- Fact - Farmers like equipment. Farmers like shiny, new fancy equipment. Just as farmers would debate the performance of one brand of truck (theirs usually being better than yours), producers can take their equipment very seriously.
- My experience with zero till and different drills goes back to 1990. During that time I have worked in plots with the Haybuster 8000, John Deere 752, Flexicoil 5000 and Concord.
- I have worked with producers who have used these drills on their personal farms.
- There are also producers I know of who are successfully using Harmon and Morris drills to ZT.
- A common question that I get asked by producers is if one drill works better than the others.



- The standard answer that I give them is no, choice of drills does not make a difference, with some exceptions.
- As with vehicle choice, a Dodge, Ford or Toyota will all perform the same job, to get you from place to place.
- Drills are the same way, some like a brand, disc/hoe, width, openers, air tank capacity, coulters.
- In the end they all perform the same function, to place seed and fertilizer in the ground without prior tillage.
- The choice probably comes down to what you need and what you can afford - I know two producers that seed adjacent fields, one with a Harmon and one with a Concord and they both produce good crops.
- One of the producers (John Sloan) that I met in 1996 expressed an interest in direct seeding. He had the usual reasons, wanting to get seeding done sooner, conserving soil and moisture and improving his bottom line.

- I set up a tillage trial with John starting in 1997 and obtained really good results with it.
- 1997 ZT canola yielded 0.8 bu/ac more than MT, in 1998 ZT canola yielded 4.7 bu/ac more and in 1999 ZT wheat yielded 4.4 bu/ac more.

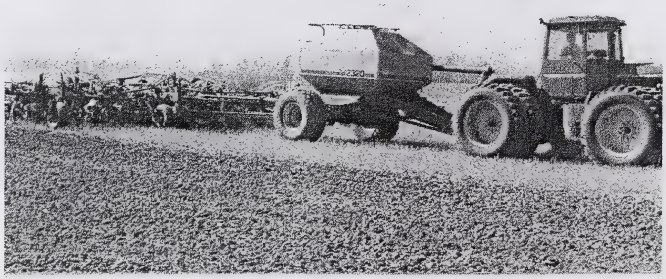
- During the spring of 1999 John started to seriously look for a drill.

- In the early spring of 2000 John found a Flexicoil 5000 with low acres and bought it.
- There have been a few equipment demos in the Peace Region but one of the problems I have had with these is the equipment people will not allow us to collect yield data.
- In 1995 one of my cooperators had use of a Flexicoil 5000 and so we did a little comparison between them and found:

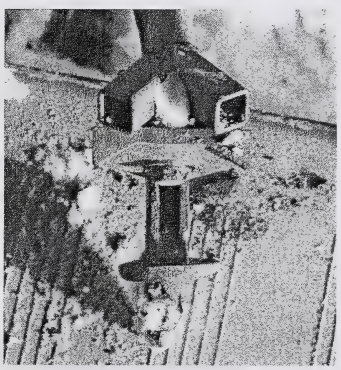
Drill	Yield bu/ac	Dockage bu/ac
Flexicoil 5000	60.3a	2.6a
Haybuster 8000	61.4a	2.3a

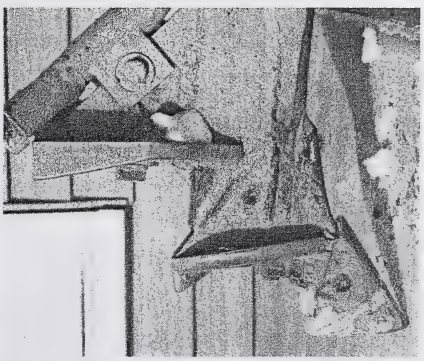
- So there were no significant differences!

- So John and I decided to repeat this trial in 2000.
- John's Flexicoil 5000 is 40" wide with a shank spacing of 12". It has Anderson openers that give a 4" paired seed row. Dry fertilizer is applied mid row and it has a Dutch knife for anhydrous applications below where the fertilizer is deep banded.

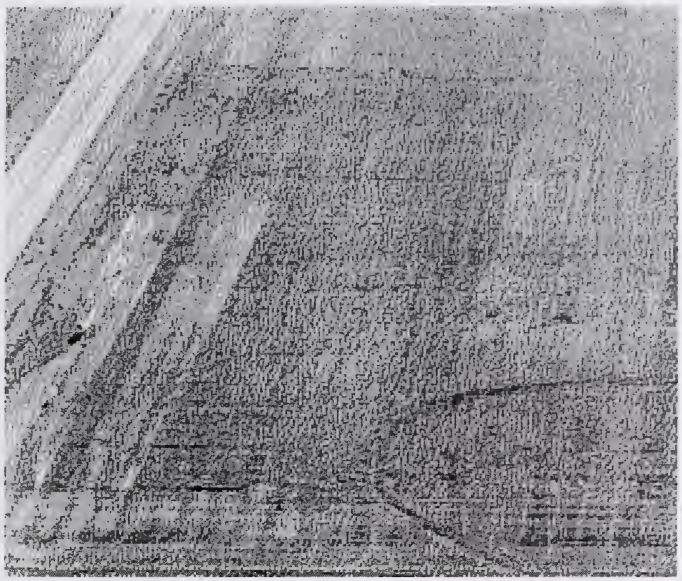


- The Haybuster 8000 has a 3" wide paired row, 10" spacing, deep bands the fertilizer below the middle of the seed row and can deep band anhydrous.





- So we seeded wheat on the same day, same seeding and fertilizing rates etc.
- Drill — Yield bu/ac
  Flexicoil, MT — 56.0a
  Haybuster, MT — 61.2 b
- Flexicoil, ZT — 59.5a
  Haybuster, ZT — 62.0 b
- So the Haybuster 8000 produced higher yields than the Flexicoil with either tillage system.
- Some of you may think that I am a little out to lunch to be such a strong supporter of the Haybuster but I think that I have other reasons why……..



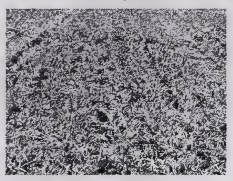
Bourgault 8800
Flexicoil
CENTRAL PEACE
CONSERVATION
SOCIETY
Hay Buster 8000
Drill Hoe Drill

Haybuster 8000
Flexicoil 5000

Pea Fertility in Direct Seeding

Paul Laflamme, P.Ag.
Pulse and Special Crops Specialist
Alberta Agriculture, Food and Rural Development
Grande Prairie, Alberta

Pea Fertility in Direct Seeding



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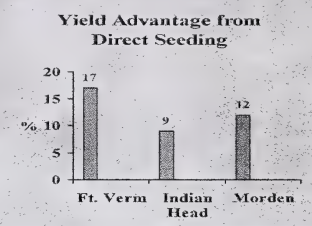
Background

- Peas show good response to direct seeding



Background

- Reports in literature of poor response to fertilizer application in field pea
- Dr. Ross McKenzie project on Pea Fertility in Alberta
  - had several sites in the Peace
- No response to P_2O_5, K or S in 4 years of study from sites in Peace

Background

- Local farmers started trying test strips on their farms with no fertilizer
- Most saw no difference in yield between fertilized & unfertilized strips
- Word spread from farmer to farmer

Background

- Farmer A: 25 acre test strip with no fertilizer
  - Yield : 55 bus/ac (same as rest of field with 30 lb/ac P_2O_5 fertilizer)
  - no longer using fertilizer
- Farmer B: 140 acres with no fertilizer
  - Yield: 57 bus/ac
  - soil test after peas: 45 lb/ac of P_2O_5 for 35 bus/ac canola crop
  - not using fertilizer with pea crop

Plant Nutrients Removed

Crop	Crop Part	Nitrogen lb/ac	Phosphorus P205 lb/ac	Potassium (K20) lb/ac	Sulphur (S) lb/ac
Field Pea 50 bus/ac	Seed	117	35	35	7
	Straw	36	8	102	6
	Total	**153**	**43**	**137**	**13**
Wheat 40 bus/ac	Seed	60	23	17	4
	Straw	25	9	55	5
	Total	**85**	**32**	**72**	**9**
Canola 35 bus/ac	Seed	68	41	21	12
	Straw	44	17	72	10
	Total	**112**	**58**	**93**	**22**

Pea Fertility Research Results

- McKenzie *et al.* in Alberta - Pea Fertility
  - 30-40% of sites over 4 yrs showed response to added P_2O_5 but response small (<2 bus/ac)
  - peas much less responsive than cereals & oilseeds
- Johnston & Lafond in Saskatchewan
  - only 1 of 10 trials over 2 years showed response to added P_2O_5, K_2O & S
- Hogg & Wahab in Sask (irrigated peas)
  - response to P_2O_5 in only 1 year of 2 year study
  - No response to K_2O

Pea Fertility Research Results

- Lafond in Sask - P_2O_5 & Sulphur
  - Gray soils low in available P_2O_5 & S
  - 20% increase in yield from 20 lb/ac of P_2O_5
  - 19% increase in yield from 20 lb/ac of S
  - Similar yield increase from P_2O_5 & S together
- Ferrie & Slinkard in Sask - Sulphur
  - soils low in available S
  - no response to added S from 11 sites over 3 yrs
- Halford in Sask - Sulphur
  - no response to added S

What's Happening?

- Only theories to explain what's happening
- Peas are better scavengers of nutrients than other crops
- Peas have a shallow root system with more roots near soil surface
- Direct seeding concentrates nutrients near surface
- Peas better able to use surface nutrients

What's Happening?

- Around every root is a zone called the rhizosphere (< 1mm)
- Non-legume plants take up N as nitrates
  - ↑pH in rhizosphere
- Pea roots don't need to take up nitrates; acidification in rhizosphere: ↓pH
  - ↓pH solubilizes phosphorus making more of it available to the plant

Should You Fertilize Peas?

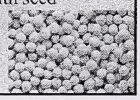
- Peas high users of nutrients (50 bus/ac)
  - 153 lb/ac N
  - 43 lb/ac P_2O_5
  - 137 lb/ac K_2O
  - 13 lb/ac S
- Good inoculation critical to supply needed Nitrogen

Should You Fertilize Peas?

- Select soils low in available N
  - avoid manured fields
  - N levels in soils above 30 lb/ac reduce nodulation & N fixation
  - N fixation shuts down when N above 55 lb/ac
- Do a good job of inoculation
  - Store inoculant properly
  - inoculate just prior to seeding
  - use recommended rates for granular inoculant

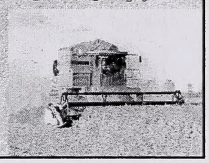
Should You Fertilize Peas?

- Field History
  - regular use of N,P, K, S in other crops in rotation
  - soil test level of P_2O_5 & other nutrients
- Convenience Factor
  - only have 2 tanks on air seeder & want to use granular inoculant
  - can only add 15 - 20 lb/ac of P_2O_5 with seed
- Reduced Input Costs
  - only seed & inoculant cost



Should You Fertilize Peas?

- High Yields
  - if shooting for 70+ bus/ac need a lot of nutrients
    - 200+lbs N, 60+lbs P_2O_5 ....
  - peas may not be able to scavenge enough P_2O_5, K_2O & S for high yields
  - fertilizer may be needed



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